TO DETERMINE SHOULDER FUNCTION AFTER ARTHROSCOPIC ROTATOR CUFF REPAIR

A THESIS SUBMITTED TO THE BABA FARID UNIVERSITY OF HEALTH SCIENCES

FOR THE AWARD OF

MASTER OF SURGERY

IN

ORTHOPAEDICS

BY

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Dedicated

to

my

Parents

ACKNOWLEDGMENT

*At the outset, I want to thank the **Lord Almighty** for giving me the strength and blessings to complete this task. The thesis has probably been the most challenging task of my life till now.*

*The first debt of heartful gratitude goes to my esteemed Supervisor **Dr.Rajnish Garg**, Professor, and Head, Department of Orthopaedics, Dayanand Medical College and Hospital, Ludhiana who has guided me right from finding an appropriate subject in the beginning to the step-by-step process of thesis writing by his thought-provoking ideas, keen interest, and inspiring influence.*

*I would also like to thank my Co-supervisor, **Dr. Pankaj Mahindra**, Professor, Department of Orthopaedics, Dayanand Medical College and Hospital, Ludhiana, for his constant cooperation and for imparting me the most valuable guidance, for which I shall always remain indebted.*

*I express my cordial thanks to **Dr. Harpal Singh Selhi, Dr Deepak Jain, Dr. Shekhar Singal and Dr. Raskesh Malhotra** who have constantly supported me with their academic orientation and experience. Their guidance has been of profound help to me during my work.*

*Acknowledging the efforts of my mother **Mrs. Mridhu Khosla** and father **Dr. Sanjeev Khosla** for being a constant support, giving me the confidence to carry out this work and without their prayers and wishes, this work would not have been possible. Many thanks to my sister **Shivani Khosla** for helping me in completing this work.*

*I am thankful to **Dr.Shifali** who has been my driving force through difficult times and for always being supportive and for giving me the most valuable suggestions in all the possible ways*

*In Team Orthopedics, I am very grateful to my seniors **Dr. Gaurav Chopra, Dr Ravi Malhotra , Dr. Hunny Bansal and Dr. Raghav Arora** who guided me*

*through every hurdle. I would also like to thank my juniors **Dr Sahil Singla and Dr Tushar Jethi** who always stood by my side for any help.*

*I am also thankful to **Mrs. Namita Bansal,** R&D DEPARTMENT for their help in the statistical work and **Mr Tarun** & **Mr. Naveen Bhatia**, whose consummate interest in typesetting and passion for details has shaped this manuscript into a transcript.*

In the end, I would like to thank my family and friends who have always been a tremendous support system.

Dr. Nitish Khosla

LIST OF ABBREVIATIONS

CHL	CORACOHUMERAL LIGAMENT
IGHLC	INFERIOR GLENOHUMERAL LIGAMENT COMPLEX
IS	INFRASPINATUS
MGHL	MIDDLE GLENO HUMERAL LIGAMENT
RCR	ROTATOR CUFF REPAIR
ROM	RANGE OF MOTION
SGHL	SUPERIOR GLENOHUMERAL LIGAMENT
SS	SUPRASPINATUS
TM	TERES MINOR
UCLA	UNIVERSITY OF CALIFORNIA AND LOS ANGELES

ABSTRACT

Introduction: Rotator cuff tears are a common contributing factor of shoulder pain and occupational disability. Tears of rotator cuff are becoming increasingly prevalent in today's population. Shoulder arthroscopy has become a reliable and reproducible method of treating rotator cuff tears. Arthroscopic surgery allows for a shorter recovery time and predictably less pain in first few days following procedure than does any open surgery.

Objective – To Determine Shoulder Function After Arthroscopic rotator cuff repair.

Material & Methods: A prospective and retrospective review of the medical records of 37 cases of rotator cuff tear who underwent arthroscopic rotator cuff repair between January 2017 to May 2020 at Dayanand Medical college Hospital, Ludhiana was performed.

Results- In our study, we had measured UCLA shoulder score over 6 months period in 37 patients. Our study showed improved functional outcome from UCLA score at presentation- 10.27 to UCLA at 6 months- 30.41 with a p value <0.001 which is graded as a good result. There was no significant gender difference in terms of incidence and postoperative functional outcome. Maximum incidence was seen in age group- 51-60 years with etiological inclination towards precedent trauma. No statistical difference between functional outcome of single and double row technique was noted.

Conclusion- Arthroscopic repair of rotator cuff tear offers excellent functional outcome; with minimal morbidity. Improvement in pain, range of motion and strength of cuff tendons can be achieved only by meticulous repair techniques and strict rehabilitation programme.

Keywords: Rotator Cuff, Shoulder Arthroscopy, UCLA Shoulder score

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INTRODUCTION

Rotator cuff disease encompasses a wide range of pathology from minimal bursal or articular side irritation and tendonitis to severe degenerative rotator cuff arthropathy. Rotator cuff pathology affects adults of all ages and other shoulder afflictions must be ruled out by careful history and physical examination[(1)]. Epidemiological studies strongly support a relationship between age and cuff tears prevalence. In a recent study the frequency of such tears increased from 13% in youngest group (aged 50-59yrs) to 20% (aged 60-69yrs) 31% (aged 70-79yrs) and 51% in oldest group (aged 80-89yrs)[(2)].

In recent past small tears were treated arthroscopically while larger tears would require an open procedure. Advances in procedure now allow arthroscopic repair of even largest tears and arthroscopic techniques are required to mobilize many of retracted tears arthroscopic results now match open surgical techniques and allow for more thorough evaluation of shoulder at time of surgery increasing diagnostic value of procedure as several other conditions may cause shoulder pain. Arthroscopic surgery allows for a shorter recovery time and predictably less pain in first few days following procedure than does any open surgery[(3)].

During the past 3 decades, arthroscopy has dramatically changed the orthopaedic surgeon's approach to the diagnosis and treatment of a variety of joint ailments. A high degree of clinical accuracy, combined with low morbidity, has encouraged the use of arthroscopy to assist in diagnosis, to determine prognosis, and often to provide treatment. Arthroscopic procedures should serve as adjuncts to and not as replacements for thorough clinical evaluation; arthroscopy is not a substitute for clinical skills.

Progressive improvements in the lens systems of arthroscopes and fiber optic systems, in miniaturization, and in the accessory operative instruments have made possible advanced operative arthroscopic techniques for virtually every joint in the body, including the knee, shoulder, hip, ankle, elbow.

AIMS AND OBJECTIVES OF THE STUDY

1. To determine shoulder function after arthroscopic rotator cuff repair
2. To assess complications after arthroscopic rotator cuff repair

REVIEW OF LITERATURE

Burman[4] was the first to perform diagnostic shoulder arthroscopy on cadavers, in 1931, in the USA. He performed 90 arthroscopies on different cadaver joints, among which 25 were shoulders, and compared the arthroscopic findings with those seen when the joint was opened.

In a study conducted by Eric S. Millstein, MD. Stephen J Snyder in Southern California Orthopaedic Institute authors have evaluated several postoperative MRI scan of patients following arthroscopic rotator cuff repair. The appearance of tendon continues to improve becoming more robust and solid with time. It is gratifying to observe a previously thin degenerative tendon mature into a more normal looking structure over the course of year[1].

In a study by Tom Murray and George Lajtar reported minimum 2 yrs results of 45 patients with 48 medium to large cuff repairs. Average age 57-64 yrs and mean follow up was 39 months. The mean UCLA pain score improved from 3.3 preoperatively to 9.3 at follow up, function improved from 3.4 to 9.5 out of 10. Most important parameter is patient satisfaction with surgery improved from 4.9-5.0 post operatively[5].

In a study conducted by Anthony S Melilo, E H Savoie and Larry D Field for massive rotator cuff tears where they followed up 51 patients over 9 years with repair (group I) and debridement (group II) it was found that short term and midterm results of debridement seen to show satisfactory results however their long term studies currently available all report that their initial results deteriorate significantly with time and are not accepted. The average postoperative UCLA score was 32.5 in group I and 19 in group II. This represented a statistically significant difference ($P < 0.05$). Overall, 87% of the repair group and 8% of the debrided group were rated as satisfactory. In the repair group, all patients had an improvement in both active motion and the results of manual strength testing of the rotator cuff muscles. In the debridement group, patients with preoperative active flexion of less than 90 degrees (15 of 25) had less improvement than patients with active flexion

greater than 90 degrees (10 of 25). This difference was not statistically significant. The findings of study indicate that repair of these tears arthroscopically is treatment of choice[6].

There was a study conducted by Paul Saridakis, BS, and Grant Jones, MD at Department of Orthopaedics, The Ohio State University, Columbus, Ohio in 2010. In this study they analyzed six articles and they gave the following conclusion. There appears to be a benefit of structural healing when an arthroscopic RCR is performed with double-row fixation as opposed to single-row fixation. However, there is little evidence to support any functional differences between the two techniques, except, possibly, for patients with large or massive rotator cuff tears (≥ 3 cm). A risk- reward analysis of a patient's age, functional demands, and other quality-of-life issues should be considered before deciding which surgical method to employ. Double-row fixation may result in improved structural healing at the site of RCR in some patients, depending on the size of the tear[7].

In another randomized control trial study conducted in 2011 at Pan Am Clinic and University of Manitoba, Winnipeg, Manitobaand Ottawa Hospital, University of Ottawa, Ottawa, Ontario, Canada by Peter MacDonald, MD, FRCSC, Sheila McRae, MSc, Jeffrey Leiter, MSc, PhD, Randy Mascarenhas, MD, and Peter Lapner, MD, FRCSC. Their findings are consistent with previous research reports in which there was no difference in functional and quality-of-life indices for patients who had RCR with or without acromioplasty[8].

In 2008 investigation performed at the Alps surgery Institute**,** Annecy, France by Laurent Lafosse, MD, Roman Brzoska, MD, Bruno Toussaint, MD, and Reuben Gobezie, MD found that Arthroscopic repair of a rotator cuff tear with use of the double-row suture anchor technique results in a much lower rate of failure than has previously been reported in association with either open or arthroscopic repair methods. Patients with an intact RCR have better pain relief than those with a failed repair. After repair, large and massive rotator cuff tears result in more postoperative weakness than small tears do[9].

In the study conducted by In Park et al; Forty-eight patients who underwent arthroscopic repair for large to massive rotator cuff tears were included. Group I consisted of patients younger than 60 years, while patients older than 60 years were assigned to group II. Clinical outcomes were evaluated preoperatively and at 3, 6, and 12 months postoperatively, and at the final visit. All patients underwent magnetic resonance imaging (MRI) preoperatively and at 3 and 12 months postoperatively to evaluate repair integrity. More satisfactory clinical and structural outcomes followed by less advanced preoperative fatty infiltration can be expected in younger patients compared with patients older than 60 years, based on large to massive rotator cuff tear treatment outcomes[10].

Patrick J Denard conducted retrospective review of massive RCTs treated with an arthroscopic RCR over an 8-year period. Minimum 5-year follow-up was available for 126 repairs at a mean of 99 months. Among 107 complete repairs, there were 62 single row and 45 double row repairs. Functional outcome was determined by University of California, Los Angeles (UCLA). A multivariate analysis was performed to examine the role of a double row repair. For all repairs combined, improvements were observed in forward flexion (132° v 168°), pain (6.3 v 1.3), UCLA score (15.7 v 30.7) ($P < .001$). A good or excellent outcome, obtained in 78% of cases, was associated with a complete repair ($P = .035$) and a double row repair ($P = .008$). When we excluded partial repairs, postoperative UCLA gain was greater after a double row repair ($P = .007$). Patients reported their shoulder as feeling closer to normal after a double row repair compared with an single row repair (93.5% v 84.4%, $P = .006$). A double row repair was 4.9 times more likely to lead to a good or excellent outcome ($P = .021$). When a double row repair of a massive RCT is possible, on the basis of the ability to mobilize the tendons, a better long-term functional outcome can be expected compared with an single row repair. Given the known high risk of recurrence after repair of massive RCTs and the knowledge that functional outcome is related to recurrence, a double row repair of

massive RCTs should be performed when there is sufficient tendon mobility[11].

Pascal Boileau et al in 2005 conducted a study including sixty-five consecutive shoulders with a chronic full-thickness SS tear repaired arthroscopically. Patients ranged in age from twenty-nine to seventy-nine years. The average duration of follow-up was twenty-nine months. Fifty-one patients (fifty-one shoulders) had a computed tomographic arthrogram, and fourteen had a magnetic resonance imaging scan, performed between six months and three years after surgery. All patients were assessed with regard to function and the strength of the shoulder elevation. The rotator cuff was completely healed and watertight in forty-six (71%) of the sixty-five patients and was partially healed in three. Although the SS tendon did not heal to the tuberosity in sixteen shoulders, the size of the persistent defect was smaller than the initial tear in fifteen. Sixty-two of the sixty-five patients were satisfied with the result. The average University of California at Los Angeles score improved from 11.5 +/- 1.1 to 32.3 +/- 1.3 ($p < 0.001$). The average strength of the shoulder elevation was significantly better ($p = 0.001$) when the tendon had healed (7.3 +/- 2.9 kg) than when it had not (4.7 +/- 1.9 kg). Arthroscopic repair of an isolated SS detachment commonly led to near complete tendon healing[12].

Hiroyuki Sugaya conducted a consecutive series of 106 patients with full-thickness rotator cuff tears underwent arthroscopic double-row RCR with use of suture anchors and were followed prospectively and found that arthroscopic double-row repair can result in improved repair integrity compared with open or mini open repair methods[13].

Hidehiro Nakamura et al conducted a retrospective study of consecutive patients with large or massive cuff tears who underwent arthroscopic repair at our institution between 2005 and 2012. On the basis of intraoperative findings and magnetic resonance imaging at final follow-up, the patients were divided into 3 groups: healed group, retear group (after complete repair), and partial-repair group. The outcome measures comprised the University of California, Los Angeles

(UCLA) scores; muscle strength; and ROM. The tear length, tear width, muscle atrophy, and fatty degeneration were evaluated by preoperative and postoperative magnetic resonance imaging. The extent of tendon reattachment to the superior, middle, and inferior facets and the lesser tuberosity was examined on magnetic resonance images at final follow-up. The JOA and UCLA scores were significantly improved in patients with structural failure. Under these conditions, the only clinical factor that affected patient outcome was tendon healing at the middle facet. Thus tendon preservation at the middle facet was a predictor of good clinical outcomes in patients who underwent arthroscopic RCR of large or massive tears and had postoperative structural failure[(14)].

Alberto Naoki Miyazaki conducted a study of Sixty-three patients with rotator cuff injuries who underwent arthroscopic surgical treatment performed by the Shoulder and Elbow Group of the Department of Orthopedics and Traumatology, in the Fernandinho Simonsen wing of Santa Casa Medical School, São Paulo, between August 1998 and December 2007, were reassessed. The study included all patients with rotator cuff injuries who were under 50 years of age and had been followed up postoperatively for at least 24 months. Results: According to the UCLA evaluation criteria, 59 patients (92%) showed excellent and good results; five (8%) showed fair results; and none showed poor results. The postoperative evaluation showed that the mean ROM was 145° for elevation, 47° for lateral rotation and T10 for medial rotation. Unsatisfactory results were associated with prolonged duration of the injury, with a statistically significant relationship[(15)].

Luciano A Rossi et al conducted a study which included Sixty-two patients who had undergone an arthroscopic in situ repair for partial-thickness rotator cuff tears. All injuries involved the SS tendon. Clinical assessment consisted of glenohumeral range-of-motion measurement and pain was rated. We assessed return to sports and the level of performance achieved after surgery. Postoperative complications were also assessed. Arthroscopic repair of partial-thickness rotator cuff tears produces excellent functional outcomes in more than 80% of patients,

and revision rates are low. Most patients return to their chosen sport at the same level they had achieved before injury[16].

ANATOMY OF SHOULDER JOINT

The shoulder is a region of upper limb attachment to the trunk and neck. The bone framework of the shoulder consists of: The Clavicle and Scapula which forms the shoulder girdle and the proximal end of humerus.

Shoulder Joint (Glenohumeral joint):

The Glenohumeral joint is a synovial multiaxial spheroidal ball-and-socket joint between hemispherical head of humerus and a shallow glenoid fossa of the scapula.

Articulating surfaces:

It is between the large round to ovoid head of humerus and a small shallow glenoid cavity of scapula, which is approximately 4 to 1 disproportion in size respectively.

The area of humeral convexity exceeds that of the glenoid concavity such that only a small portion opposes the glenoid in any position.

Both articular surfaces are covered by hyaline cartilage, which is thickest centrally and thinner peripherally over the humerus, and the reverse in glenoid cavity.

In most positions the curvature of the articular surfaces are not fully congruent and the joint is loose-packed. Close packing (full congruence) is reached with the humerus abducted and laterally rotated.

The above facts make the shoulder joint a highly mobile and a very unstable joint.

The rotator cuff Muscles

Supraspinatus -

Origin: Medial 2/3 of supraspinous fossa of scapula.

Insertion: Upper flattened area of greater tubercle of humerus.

Function:

1.Initiate the abduction to the extent of initial 15 degree

2.Maintains stability of shoulder

Infraspinatus:

Origin: Medial 2/3 of infraspinous fossa of scapula.

Insertion: Middle impression of greater on the posterior aspect.

Function:

1. Lateral rotation of shoulder
2. Assist abduction

Teres minor:

Origin: Upper 2/3 Of flat strip on dorsal surface of lateral border of scapula

Insertion: Lowest impression of the greater tubercle of Humerus.

Function:

1.Lateral rotator of Humerus.

2.Assist Abduction

Subscapularis:

Origin: Most of the costal surface of the Scapula.

Insertion: Lesser Tubercle of Humerus.

Function: Internal rotation of Humerus

There are typically four articulations in the shoulder complex:

1. Sternoclavicular
2. Acromioclavicular
3. Scapulothoracic
4. The glenohumeral joint.

These are supplemented by a fifth “pseudo joint” between humeral head and the coracoacromial arch.

The glenohumeral joint is commonly referred to as the shoulder joint. The shoulder joint has the largest ROM amongst all the joints in the human body. The structures providing stability of shoulder have been typically classified into static and dynamic types:

- The static ones include the labrum, ligaments (discrete thickenings of capsule), capsule and to a certain extent the bones.
- The dynamic stabilizers include the rotator cuff muscles, scapular muscles, scapulothoracic rhythm and even the axial core muscles of the body.

- The most active stabilizers are the glenohumeral ligaments.

Gleno humeral rhythm: In normal abduction, the scapula moves laterally in the first 30 – 50 degrees of glenohumeral abduction. After this the scapula rotates upwardly about a fixed axis to an arc of approximately 65 degrees as the shoulder reaches full elevation. This total movement occurs at approximately a 2:1 ratio glenohumeral/scapulo thoracic movement.

MOVEMENTS AROUND SHOULDER JOINT

1. Shoulder flexion:	Anterior deltoid fibres
	Coracobrachialis
	Long head of biceps
2. Shoulder extension:	Latissimus dorsi
	Teres major
	Triceps brachii, long head
3. Shoulder abduction:	Deltoid
	Supraspinatus
	Long head of biceps
4. Shoulder adduction:	Pectoralis major
	Latissimus dorsi
	Teres major
5. Medial rotation:	Subscapularis
	Teres major
	Latissimus dorsi
6. Lateral rotation:	Teres minor
	Infraspinatus
	Deltoid

Ligamentous complex:

1. Glenohumeral ligaments.
    - Superior glenohumeral ligament
    - Middle glenohumeral ligament
    - Inferior glenohumeral ligament
2. Coracohumeral ligament.
3. Transverse humeral ligament.

Bursae: Many bursae adjoining the shoulder joint usually found between the tendon of sub-scapularis and the capsule, communicating with the joint between the superior and middle glenohumeral ligaments. Bursae exists between:

- The coracoid process and the capsule.
- Teres major and long head of triceps.
- Anterior and posterior to tendon of latissimus dorsi.

BIOMECHANICS OF SHOULDER JOINT

The shoulder's ability for multiple degrees of motion is based on the interaction of multiple structures that react to mechanical stimuli and adjust accordingly. The addition of the fibrocartilaginous labrum as well as the presence of a constrained capsule and glenohumeral ligaments adds to the stability of the shoulder. The rotator cuff muscles not only act as dynamic stabilizers, but also add to the passive stability of the shoulder due to their location and orientation around the glenohumeral joint. The static and dynamic stabilizers react to the forces applied through the glenohumeral joint to provide stability at different positions during the motion arc.

BONY STABILITY: The bony anatomy of the glenohumeral joint is an important component of shoulder stability. The humeral head articular surface is normally retroverted by 30˚. The shape of the glenoid itself is important for glenohumeral stability. Howell and Galinat reported the average anteroposterior depth of the bony glenoid to be only 2.5 mm, whereas the average superior/inferior depth was 9.0 mm[17]. In a study by Soslowsky and colleagues it was shown that the articular surfaces

deviated from each other by an average of 2mm. Hence, areas of contact vary at different degrees during the motion arc. In abduction, the humeral head is more congruent with the glenoid, the contact area is increased and the pressure is decreased[18].

Along with the glenoid and humeral head articular surfaces, the glenoid labrum adds depth to the glenoid cavity (by 50%). The increased depth of the glenoid and the compressive forces that stabilize the humeral head have been called “concavity compression”[19].

MUSCULAR STABILITY:

1. SCAPULOTHORACIC MUSCLES: The stability of the glenohumeral joint is also affected by the large muscles acting away from the shoulder joint itself. The latissimus dorsi, serratus anterior, pectoralis major, and deltoid can generate large torques about the shoulder joint due to their cross-sectional anatomy and distance from the joint center of rotation. The scapulothoracic articulation comprises a space between the surface of the posterior thoracic cage and the surface of the anterior scapula[20].
2. ROTATOR CUFF MUSCLES: The rotator cuff can be considered a fine control muscle system, adjusting through neuromuscular feedback from the forces generated during the motion arc and by feedback from the glenohumeral ligaments. By virtue of this fine control, the cuff muscles also act as pretensioners or cotensioners for the capsular ligaments.

LIGAMENTOUS AND LABRAL STABILITY:

LIGAMENTS: The glenohumeral ligaments are lax through mid-ranges of motion and become progressively more taut as the end-range of the motion arc is reached. Preservation of this ligamentous integrity is integral in stability during end-ranges of motion.

1. SUPERIOR GLENOHUMERAL LIGAMENT (SGHL)

Resists inferior translation with the adducted arm in neutral rotation

Along with the coracohumeral ligament (CHL), it limits external rotation of the adducted shoulder.

2. MIDDLE GLENOHUMERAL LIGAMENT (MGHL)

Anterior stabilizer with arm in adduction and up to 30–45◦ abduction.

3. INFERIOR GLENOHUMERAL LIGAMENT COMPLEX (IGHLC)

Has three components: an anterior band, an axillary pouch, and a posterior band. The anterior band originates from the anterior labrum and attaches to the glenoid rim.

Resists anteroinferior humeral head translation, especially with the arm in external rotation, abduction and extension.

4. CORACOHUMERAL LIGAMENT (CHL)

Resists posterior and inferior translation in the suspended shoulder Inferior stabilizer with the arm in adduction, and it tightens with external rotation.

Karduna et al. described the concept of ligamentous laxity during the mid ranges of motion when the dynamic muscle forces provide the primary stability to the glenohumeral joint[21].

THE GLENOID LABRUM: The glenoid labrum is an integral component of this articuation. It is a ring of triangular shape in section overlying the periphery of the glenoid.

The labrum has two primary mechanical functions. The first function is to serve as an attachment site for the glenohumeral ligaments to the glenoid rim. The second mechanical function of the glenoid labrum is to function as an antishear bumper, which is more evident during mid-ranges of shoulder motion.

STATIC VS DYNAMIC STABILITY

BASIS OF STATIC STABILITY: Static stabilizers refer to bony, cartilaginous, capsular, and ligamentous structures. The glenohumeral ligaments serve as static stabilizers preventing excessive translation of the humeral head, especially in the extremes of motion. The relationship between the static stabilizers of the shoulder can be explained by the circle concept of capsuloligamentous stability, which implies that excessive translation in one direction may require damage to restraints on the same and opposite sides of the joint[22].

BASIS OF DYNAMIC STABILITY: Active stability is primarily the result of neuromuscular control between the scapulothoracic musculature and the rotator cuff muscles. Rapid neural feedback in response to

forces that could induce risk of ligament failure probably cause an appropriately protective reaction in most shoulders. The rotator cuff acts as a force couple around the joint, with coactivation of agonist and antagonist muscles, as well as coordinated activation of the agonist and inhibition of the antagonist muscle. The specialized anatomy of the rotator cuff muscles and the long head of the biceps are situated in an ideal configuration to actively compress the humeral head into the glenoid cavity[22]. Disruption of the coupled activity of the rotator cuff muscles can affect the force couples generated and hence contribute to instability. Rupture of the rotator cuff can permit anterior dislocation of the humeral head on an intact anterior soft tissue surface. Tear size has greatest effect on stability in the inferior direction for tears centered at the critical area (supraspinatus with extension to IS) and in the anterior direction for tear centered at the rotator interval[22].

The glenohumeral ligaments are usually lax during midranges of motion when the humeral head is centered within the glenoid. As the shoulder approaches end-ranges of motion, the ligaments become progressively tighter, acting as check reins at the ends of the motion arc. Labriola et al. showed that in end-range positions, simulated increases in rotator cuff muscle forces tended to improve the stability while increases in deltoid or pectoralis major muscle forces tended to further decrease stability[23]. Itoi et al. found that the subscapularis was a less effective stabilizer of the glenohumeral joint than the other rotator cuff muscles and that the long head of the biceps may contribute to stability[24].

CLASSIFICATION OF ROTATOR CUFF PATHOLOGY

Rotator cuff pathology spans a spectrum of severity that includes rotator cuff tendinopathy, partial-thickness tears, full-thickness tears, and rotator cuff arthropathy. Numerous different classification systems have been devised to try to better describe rotator cuff pathology.

Neer[25] initially described three different stages of cuff lesions:

- Stage 1: Reversible edema and hemorrhage are present in a patient younger than 25 years.

- Stage 2: Fibrosis and tendinitis affect the rotator cuff of a patient typically in the 25- to 40-year-old age group. Pain often recurs with activity.
- Stage 3: Bone spurs and tendon ruptures are present in a patient older than 40 years.

PARTIAL THICKNESS TEARS

Ellman[26] Classification for Partial-Thickness Rotator Cuff Tears

	Location	Grade	Size
A	Articular	1	<3 mm
B	Bursal	2	3-6 mm
C	Interstitial	3	>6 mm

FULL THICKNESS TEARS

There are numerous classification schemes of full thickness tears, all of which are extremely diverse in their attempts to describe the tear size, number of tendons involved, tear shape, chronicity, tendon quality, and muscle atrophy.

Tear Size/Number of Tendons Torn

One of the most commonly used classifications for the size of full-thickness rotator cuff tears was described by DeOrio and Cofield[27]. Groups are stratified by tear size from anterior to posterior: less than 1 cm is small, 1 to 3 cm is medium, 3 to 5 cm is large, and more than 5 cm is massive.

Tear Shape

A classification developed by Ellman and Gartsman attempted to characterize tears by their three-dimensional shapes[28]. This classification includes crescent, reverse L, L-shaped, trapezoidal, and massive tears

Patte Classification-

Patte developed a complex and comprehensive classification system that incorporates both tear size coronal and sagittal imaging, tendon

retraction, muscle atrophy, and integrity of the long head of the biceps tendon

1. Extent of Tear

Group I: Partial tears and full-thickness tears <1 cm in sagittal diameter

A: Deep, partial tears

B. Superficial tears

C. Small, full substance tears

Group II: Full substance tears of the entire supraspinatus

Group III: Full substance tears involving more than one tendon

Group IV: Massive tears with secondary osteoarthritis

2. Topography of Tear in Sagittal Plane

Segment 1: Subscapularis tear

Segment 2: Coracohumeral ligament tear

Segment 3: Isolated supraspinatus tear

Segment 4: Entire supraspinatus and half of infraspinatus tear

Segment 5: Entire supraspinatus and infraspinatus tear

Segment 6: Subscapularis, supraspinatus, and infraspinatus tear

3. Topography of Tears in Frontal Plane

Stage 1: Proximal stump close to bony insertion

Stage 2: Proximal stump at level of humeral head

Stage 3: Proximal stump at level of glenoid

4. Trophic Quality of Muscle of Torn Tendon

5. State of Long Head of Biceps

Muscle Atrophy and Fatty Infiltration

The most common reference for classification of fatty infiltration of the rotator cuff musculature is that described by Goutallier et al[29].

Grade 0 Normal muscle without fatty streaks

Grade 1 Muscle has some fatty streaking

Grade 2 Fatty infiltration present, but less than muscle

Grade 3 Equal amount of fat and muscle tissue

Grade 4 More fat than muscle

Mechanism of injury

Many patients may describe a history of trauma initiating their symptoms, but in most cases, trauma is not the only factor involved in rotator cuff tearing. Both extrinsic (e.g., subacromial impingement, internal impingement, tensile overload, repetitive stress) and intrinsic (e.g., poor vascularity, changes in matrix composition and mechanical properties, aging) factors may be involved. However, the relative contribution of these factors in the pathogenesis of rotator cuff disease and tearing remains unclear. The two most commonly cited causes of rotator cuff tears are subacromial impingement and tendon degeneration. In 1972, Neer implicated the shape of the coracoacromial arch in the pathogenesis of rotator cuff disease and proposed that the anterior third of the acromion, the coracoacromial ligament, and the acromioclavicular joint might compress and damage the rotator cuff. Bigliani et al. classified the acromial morphology of 140 cadavers into three different types, based on the shape of the acromion on the SS outlet view: 17% of specimens were type I (flat acromion), 43 % were type II (curved acromion), and 40% were type III (hooked acromion). In type II and III acromions, there was a significant increase in rotator cuff tears. Although the controversy continues to rage over whether these findings are primary causative factors or secondary changes, it appears that abnormal contact, whether primary or secondary, may aggravate an intact but dysfunctional rotator cuff and may also compromise repair.

The degenerative changes associated with rotator cuff tears have been well documented. Various authors have demonstrated these pathologic changes (e.g., disruption, disorganization and thinning of collagen fascicles, dystrophic calcifications, formation of granulation tissue) and have correlated the presence of these findings with a significant decrease in the ultimate tensile strength of the SS tendon insertion. Thus, in patients with a degenerative rotator cuff, trivial trauma (e.g., lifting a box) can lead to a complete tear.

HISTORY

Most patients with rotator cuff tears recall a specific incidence or repetitive injury that initiated their symptoms. However, in many cases there is also a long-standing history of intermittent shoulder pain that has become progressively symptomatic. When presenting to the physician, most patients complain of anterolateral shoulder pain that is typically aggravated by repetitive use of the arm overhead. In severe cases, pain can be constant, with a significant component of night pain, and symptoms are usually prolonged, relentless, and functionally disabling.

PHYSICAL EXAMINATION

A standardized physical examination should include inspection, ROM, and strength testing in order to assess the various clinical manifestations of cuff disease including stiffness, weakness, instability, and roughness. An especially relevant point in the physical examination is an accurate assessment of the strength of the rotator cuff musculature, deltoid muscle, and scapular stabilizers. This physical assessment often forms the basis of any ongoing management program.

Crepitus should be noted with palpation of the shoulder during ROM. Roughness associated with cuff disease is manifested as symptomatic crepitus on passive glenohumeral motion. Bursal hypertrophy, adhesions, secondary changes in the under surface of the coracoacromial arch, loss of integrity and smoothness of the upper aspect of the cuff tendons, and uncovering of the tuberosities can all contribute to subacromial abrasion. Crepitus from subacromial abrasion is easily detected by placing the examiner's thumb and fingers on the anterior and posterior aspects of the acromion while the humerus is moved relative to the scapula. Because many shoulders demonstrate asymptomatic subacromial crepitus, it is important during the examination to ask whether the crepitus noted by the examiner reproduces the patient's complaints.

Tendon defects can also be assessed by palpation of the shoulder. Limitations in passive and active ROM should be documented.

Restriction in motion due to arthritis or adhesive capsulitis needs to be ruled out. Stiffness often presents as a result of partial-thickness cuff lesions, but it can also be associated with full-thickness cuff defects[30].

Palpation:

The shoulder girdle palpated for local tenderness and muscle tone.

Patients with anterior sub-luxation often have tenderness over the posterior capsule.

Patients with anterior instability caused by subluxation and secondary impingement may have tenderness over the greater tuberosity or biceps tendon.

Range of Motion:

Both active and passive range of motion recorded.

Forward flexion (Forward elevation) -normal range(0-165º)

Abduction –normal range(0-170º)

Adduction -normal range(0-50º)

Internal rotation in abduction of 90º-upto 70º

External rotation in abduction of 90º -upto100º

Generalized ligamentous laxity may be associated with shoulder instability; this is assessed by evaluating ROM in several joints. The degree of thumb hyper extension with volar flexion of wrist as well as index finger, elbow and knee hyperextension noted.

SPECIFIC TESTS:

JOBE TEST: The test is performed by placing the shoulder in 90 degrees of abduction and 30 degrees of forward flexion and internally rotated so that the thumb is pointing toward the floor. Muscle testing against resistance shows weakness or insufficiency of the supraspinatus owing to a tear or pain associated with rotator cuff impingement.

EXTERNAL ROTATION LAG SIGN

The external rotation lag sign test is designed to test the integrity of the SS and IS tendons. The patient is seated with his or her back to the examiner. The elbow is passively flexed to 90 degrees, and the shoulder is held at 20 degrees of elevation and near maximal external rotation (maximal external rotation minus 5 degrees to avoid elastic

recoil in the shoulder) by the examiner. The patient is asked to maintain the position of external rotation actively as the examiner releases the wrist, while maintaining support of the arm at the elbow. The sign is positive when a lag, or angular drop, occurs. As with all tests, performance and interpretation are complicated by pathologic changes in the passive ROM.

EXTERNAL ROTATION STRESS TEST

The external rotation stress test is intended to test the integrity of the external rotators of the shoulder, specifically the IS and the TM. With the patient's arms by his or her side in neutral flexion and abduction, the shoulders are externally rotated 45 to 60 degrees. The examiner applies force against the dorsum of the hands, attempting to rotate the shoulders internally back to neutral while the patient is asked to resist. Pain and weakness suggest inflammation or tearing of the IS or the TM or both.

DROP SIGN

The drop sign is intended to test the integrity of the IS. The patient is seated with his or her back to the examiner. The affected arm is held at 90 degrees of elevation in the scapular plane and at almost full external rotation with the elbow flexed at 90 degrees. The patient is asked to maintain this position actively as the examiner releases the wrist while supporting the elbow, which is mainly a function of the infraspinatus. The sign is positive if a lag or "drop" occurs.

LIFT-OFF TEST

With the patient seated or standing, the arm is internally rotated, and the dorsum of the hand is placed against the lower back. If the patient is unable to lift the dorsum of the hand off the back, the test is positive. Electromyography has confirmed that the subscapularis muscle is maximally active with the hand in the mid lumbar position and with resistance applied.

BELLY PRESS TEST

In this test, the patient presses the abdomen with the flat of the hand and attempts to keep the arm in maximal internal rotation. If active internal rotation is strong, the elbow does not drop backward, meaning

it remains in front of the trunk. If the strength of the subscapularis is impaired, maximal internal rotation cannot be maintained, the patient feels weakness, and the elbow drops back behind the trunk. The patient exerts pressure on the abdomen by extending the shoulder, rather than by internally rotating it. Other investigators have noted that when the subscapularis tendon is torn, patients tend to flex the wrist to press against the abdomen and are unable to hold the elbow forward.

PATTE (HORNBLOWER) SIGN

The Patte sign is used to determine the strength of the teres minor. With the patient standing, the examiner elevates the patient's arm to 90 degrees in the scapular plane and flexes the elbow to 90 degrees. The patient is then asked to laterally rotate the shoulder. Weakness and/or pain constitutes a positive test.

DIFFERENTIAL DIAGNOSIS

1. A **snapping scapula** can produce shoulder pain on elevation and a catching sensation somewhat reminiscent of the subacromial snap of a cuff tear. However, the latter can usually be elicited with the scapula stabilized while the arm is rotated in the flexed and somewhat abducted position. Scapular snapping generally arises from the superomedial corner of the scapula and produces local discomfort; scapular movement without glenohumeral motion elicits it.
2. **Glenohumeral arthritis** can also produce shoulder pain, weakness, and catching. This diagnosis can be reliably differentiated from rotator cuff disease by a careful history, physical examination, and roentgenographic analysis.
3. **Acromioclavicular arthritis** can imitate cuff disease. Characteristically, however, the shoulder is most painful with cross-body movements and with activities requiring strong contraction of the pectoralis major. Tenderness is commonly limited to the acromioclavicular joint. Relief of pain on selective lidocaine injection and coned-down radiographs can help establish the diagnosis of acromioclavicular arthritis.

4. **Suprascapular neuropathy and cervical radiculopathy** are common imitators of cuff disease. The suprascapular nerve and the fifth and sixth cervical nerve roots supply two of the most important cuff muscles: the SS and IS. Thus patients with involvement of these structures can have lateral shoulder pain, and can lack strength of elevation and external rotation.
5. **Cervical spondylosis** involving the fifth and sixth cervical nerve roots can imitate or mask rotator cuff involvement by producing pain in the lateral aspect of the shoulder as well as weakness of shoulder flexion, abduction, and external rotation. Cervical radiculopathy is suggested if the patient has pain on neck extension or on turning the chin to the affected side. Pain of cervical origin more commonly includes the area of the trapezius muscle along with the area of the deltoid, and can radiate down the arm to the hand. Sensory, motor, or reflex abnormalities in the distribution of the fifth or sixth cervical nerve root provide additional support for the diagnosis of cervical radiculopathy.
6. **Suprascapular neuropathy** is characterized by dull pain over the shoulder that is exacerbated by movement of the shoulder, weakness in overhead activities, wasting of the supraspinatus and infraspinatus muscles, weakness of external rotation, and normal radiographic evaluation. This condition can arise from suprascapular nerve traction injuries, suprascapular nerve entrapment, brachial neuritis affecting the suprascapular nerve, or a ganglion cyst in the spinoglenoid notch. The first three should involve the nerve supply to both the supraspinatus and infraspinatus, and are most easily differentiated by the history.

IMAGING OF THE ROTATOR CUFF:

XRAYS: Plain radiographs of the shoulder can be obtained as a standard evaluation of any patient with suspected rotator cuff abnormality. These include an anteroposterior (AP) view, true AP in the scapular plane (Grashey view) in 30 degrees of abduction, a scapular Y view, and an axillary view. Superior displacement of the humeral head in relation to the acromion and glenoid suggests that the rotator

cuff is compromised. A Grashey view in 30 degrees of abduction allows for interpretation of plain films with an activated deltoid muscle. The superiorly directed force of the activated deltoid can make proximal humeral migration more evident in the setting of a large, chronic tear. The scapular Y view can characterize acromial morphology. An axillary view should be obtained with the arm in the scapular plane in neutral rotation. Adequate visualization of “the eye” or the spinoglenoid notch is important in ensuring correct rotation. This axillary view is important in assessing joint space narrowing associated with arthritis and anterior or posterior joint subluxation.

PICTURE 1 True AP (Grashey) view with 30 degrees of abduction activates the deltoid and provides a superiorly directed vector that may make proximal humeral migration more evident.

MRI :

MRI is now the most often used imaging modality for comprehensive assessment of the shoulder. It can be used to assess the rotator cuff, labrum, capsule, and cartilage.

A standard protocol for the rotator cuff should include T1-weighted, fat-saturated proton-density (PD)- weighted, and fat-saturated T2-weighted imaging in the oblique coronal, oblique sagittal, and axial planes. PD and T2-weighted imaging are useful in assessing the integrity of the rotator cuff tendons. Fat saturation is useful to highlight fluid edema only. T1-weighted images highlight fat, and are useful for assessing fatty infiltration associated with chronic rotator cuff tears.

The rotator cuff tendons should demonstrate low signal intensity on all pulse sequences. Cuff tendinopathy shows intermediate signal intensity on T2-weighted images, and partial- and full-thickness tears demonstrates high signal intensity. It should be noted that in many asymptomatic patients over the age of 60 years, intermediate signal will be seen in the tendon and does not necessarily imply a pathologic state. Rotator cuff tears typically initiate in the superior cuff and can be initially assessed on PD-weighted and T2-weighted coronal imaging. Additional evaluation of sagittal and axial imaging can allow for three-dimensional characterization of the tear. If a tear is identified, fatty infiltration and atrophy of the muscle belly should be evaluated on the T1-weighted sagittal oblique images as a method to grade chronicity and the likely reparability of the tear.

The accuracy of MRI as a diagnostic tool for full-thickness rotator cuff tears is excellent, and it has high sensitivity and specificity. The utility of MRI for partial-thickness tears is more limited, but because of the limitations of physical examination for diagnosing partial-thickness tears, it does provide useful information for the clinician. MR arthrography may improve the diagnosis of subtler cuff pathology such as partial-thickness rotator cuff tears, but the necessity of injecting gadolinium through normal cuff structures may occasionally lead to interpretative errors.

PICTURE 2 A, Coronal T2-weighted image demonstrating a massive retracted full-thickness rotator cuff tear.

B, Sagittal oblique T1-weighted image demonstrating severe atrophy of the supraspinatus and infraspinatus muscle bellies.

Ultrasonography

Ultrasound is an imaging modality that can be utilized to perform dynamic evaluation of the cuff and long head of the biceps tendon. It is less expensive than MRI but is more highly dependent on the operator and the interpretation of the ultrasound images. High frequency (10 to 18 MHz) transducers are used for the shoulder. Because ultrasound is more subject to interpretation errors, the physician evaluating the images should be aware of artifacts that can cause false-negative or false-positive interpretations.

Normal tendon should appear as uniform echogenicity with a fibrillar pattern when the transducer is perpendicular to the tendon axis. Because normal tendon is anisotropic, when the beam is not perpendicular to the tendon, a hypoechoic signal will appear. This should be differentiated from tendinosis, which also produces a heterogeneous echotexture. The tendon should be interpreted as abnormal only if the area maintains a hypoechoic signal as the transducer is moved perpendicular to the tendon axis. A focal area of hypoechogenicity can diagnose partial- and full-thickness tearing with discontinuity of the normal fibrillation pattern of tendons. Compression of the transducer into the area in question can increase the gap size between the tendon fibers and bone and assist in evaluation.

Ultrasonography has also been reported to have similar accuracy to MRI in the detection of full-thickness rotator cuff tears. As mentioned previously, this modality has more significant variability in interpretation, and experience may play a larger role in decreasing the number of false-positive and false-negative interpretations.

PICTURE 3 Ultrasound image demonstrating a focal area of hypoechogenicity and discontinuity of tendon fibers indicative of a full-thickness rotator cuff tear.

NATURAL HISTORY OF ROTATOR CUFF DISEASE

There is a high prevalence of rotator cuff pathology in the aging population. While the exact prevalence varies among studies, a consistent finding is that increased age is associated with a higher prevalence of rotator cuff pathology. In a study using bilateral shoulder ultrasound in patients with unilateral shoulder pain, the average age of patients with bilaterally intact cuffs, unilateral cuff tears, and bilateral cuff tears formed an almost perfect 10-year distribution of 48.7, 58.7, and 67.8 years, respectively[31].

Maman et al. followed 59 full and partial-thickness tears with MRI for a minimum of 6 months[32]. In those tears followed for at least 18 months, 48% were found to have progression of tear size, compared with only 19% in those tears followed for less than 18 months. Safran et al. studied a cohort of patients under the age of 60 years that were treated nonoperatively for full-thickness rotator cuff tears, and found that 49% of the tears increased in size[33].

INDICATIONS FOR ROTATOR CUFF REPAIR

Patients can generally be divided into three main categories that are based on the potential risk of nonoperative treatments and the proposed benefits of surgical intervention. These categories include those patients needing urgent or early operative repair, those patients that can benefit from a trial of conservative treatment, and those patients that may be best suited for nonoperative treatment.

Group I: Early Operative Repair—Acute Tear

It includes a young patient that presents with shoulder pain and weakness after a distinct, acute injury and imaging consistent with an acute full-thickness rotator cuff tear. A thorough history should be performed and should evaluate for preexisting shoulder pain or dysfunction that could be a sign of an acute-on-chronic tear. Urgent repair in the setting of an acute rotator cuff tear typically has positive results[34].

Group II: Trial of Nonoperative Treatment—Nonacute Tear

A trial of nonoperative treatment aimed at retaining comfort, motion, and strength should be considered in any patient with chronic rotator cuff tendinitis, partial-thickness tear, or full-thickness tear. While such shoulders carry a risk for tear enlargement for full-thickness tears (61%), partial-thickness tears (44%), and intact cuffs (14%)[35], there is time and opportunity to explore the effectiveness of a gentle progressive rehabilitation program. Nonoperative approach to full-thickness rotator cuff tears can lead to clinical improvement[36].

Group III: Maximize Conservative Care—Irreparable Tear

Patients over the age of 60 years with large degenerative tears are unlikely to heal from an attempted cuff repair[12]. In an elderly patient (60 years and older) with a complete or partial rotator cuff defect, administration of a physician-directed, home-based rehabilitation program has proved to be an effective, reproducible, and reliable method of attaining significant clinical and functional improvement.

MANAGEMENT OF ROTATOR CUFF TEARS

NON-OPERATIVE

ARTHROSCOPIC ROTATOR CUFF REPAIR

MINI-OPEN ROTATOR CUFF REPAIR

NON-OPERATIVE

PHASE 1: PAIN CONTROL - NSAIDS, rest, activity modification, and use of either ice packs or moist heat

PHASE 2: STRETCHING - gentle progressive assisted forward flexion, extension, internal and external rotation, posterior capsular stretching, and pendulum exercises.

PHASE 3: STRENGTHING - It focuses on strengthening exercises for the deltoid, scapular stabilizers
(pectoralis, teres major and minor, trapezius, serratus anterior, and latissimus dorsi) and the parts of the rotator cuff that remain intact.

ARTHROSCOPIC ROTATOR CUFF REPAIR

Advances in arthroscopic equipment and increased surgeon familiarity with shoulder arthroscopy have made arthroscopic surgery the preferred method of rotator cuff repair for many shoulder surgeons. It offers numerous advantages over traditional open repair techniques.

1. More thorough visualization, diagnosis, and treatment of lesions within the joint are facilitated, which is critical because a high prevalence of concomitant intra-articular pathology has been reported in patients undergoing rotator cuff repair[(37)].
2. Arthroscopy allows a more comprehensive assessment of intra-articular pathology and rotator cuff tear configuration by viewing from multiple angles.
3. Tendon mobilization is also facilitated by precise releases of adhesions that limit tendon excursion, leading to an improved ability to anatomically reduce the edge and create a tension-free repair.
4. Injury to the deltoid muscle is minimized.
5. The acromial deltoid origin is preserved, eliminating the risk of deltoid dehiscence.

6. Another key theoretical benefit of arthroscopic repair is decreased postoperative pain secondary to less soft tissue trauma. This aids in postoperative rehabilitation, leading to earlier resumption of ROM and possibly less pain-induced muscle inhibition.
7. Anatomic footprint restoration is now possible, with fixation at both the suture-tendon interface and the anchor-bone interface that approximates traditional open transosseous repairs.

Historically, arthroscopic repair was performed using a single row of bone anchors placed within the tuberosity. The double-row technique involved the use of two rows of suture anchors, one medially and one laterally, with the sutures tied separately. This allows for additional points of fixation of the tendon down to the bone and better coverage of the footprint area. Newer techniques have involved using a medial row of suture anchors, with suture strands passed medially to a lateral row of anchors in order to compress the tendon down to the bone. The double-row technique has been advocated as a better biomechanical construct and a more anatomic repair strategy[38,39]. While in biomechanical studies, the double-row repair outperforms single-row repair in failure strength, superior clinical results with double-row fixation over single-row fixation is still controversial[40,41].

MATERIALS AND METHODS

SOURCE OF DATA

The purpose of our study was to determine the shoulder function after arthroscopic rotator cuff repair. A prospective and retrospective review of the medical records of all cases of rotator cuff tears who underwent shoulder arthroscopy between Jan 2017 and May 2020 at Dayanand Medical college Hospital, Ludhiana were performed.

METHOD OF COLLECTION OF DATA

Inclusion Criteria:

- Patents with repairable rotator cuff tears diagnosed after clinical examination or ultrasound or magnetic resonance imaging
- Rotator cuff tear repaired solely with the use of arthroscopy
- Patients who give informed consent and willing for follow up

Exclusion Criteria:

- Rotator cuff tear repaired with open surgery
- Massive irreaparable rotator cuff tear
- Severe glenohumeral arthritis
- Biceps injury requiring tenotomy or tenodesis
- Patient managed conservatively

Medical records were studied to obtain demographic data including patient age and gender, mechanism of injury, date of injury, date of surgery. Operative reports were reviewed to determine the specific fixation technique. Retrospective Study was done based on the information obtained from the documentation in the follow-up records. The follow-up information also included occurrence of any late complication or the need for additional surgery including implant removal. The duration and physiotherapy programme followed was noted. The minimum period of follow-up was 1 month and maximum period was 6 months. Patients were assessed as per the UCLA Shoulder scoring system. The final functional outcome was graded as Good (score- 28 to 33)/Excellent (score- 34 to 35) (Score >27 out of 35) and Fair (22-27)/Poor (<21) (Score <27 out of 35) as per documented in the UCLA shoulder rating sheet.

STUDY TYPE

Retrospective and Prospective study of functional outcome following arthroscopic repair of rotator cuff tears of the shoulder with suture anchors.

SAMPLING AND SAMPLING TECHNIQUE

A sample size of 37 patients was selected using purposive sampling technique.

STATISTICAL ANALYSIS

Data was described in terms of range; mean ±standard deviation (± SD), median, frequencies (number of cases) and relative frequencies (percentages) as appropriate. All statistical calculations were done using SPSS (Statistical Package for the Social Science) SPSS 21 version statistical program for Microsoft Windows.

SURGICAL TECHNIQUE USED

Anesthesia: general anesthesia with endotracheal tube taped securely on the side opposite to side of surgery.

Patient positioning: After inducing the patient under general anesthesia patient was put in semi beach chair position.

PICTURE 4: PATIENT POSITIONING

PICTURE 5: INSTRUMENTS FROM ABOVE DOWNWARDS GRASPER, PUNCH, PROBE, TROCAR WITH CANULA

PICTURE 6: INSTRUMENTS FROM ABOVE DOWNWARD TROCAR WITH CANNULA, CANNULA

ARTHROSCOPIC PROCEDURE PROPER

Patient Positioning

- Place on beach chair or lateral decubitus position
- pad any prominences of the extremities
- position the head and neck in neutral alignment
- ensure the entire scapula is free from the edge of the table place the arm
- place arm in articulated hydraulic arm holder

Scope Insertion

1 Outline landmarks

- outline the acromion, distal clavicle, coracoid process and portal placement

2 Place posterior portal

- mark portal 1 to 3 cm distal and 1 to 2 cm medial to the posterior lateral tip of the acromion
- make small skin incision
- place blunt trocar with the arm in 15° of abduction and 30° of forward flexion
- use lateral traction to avoid damage to the articular surface
- place the 30° arthroscope

3 Place anterior portal

- halfway between acromioclavicular joint and the lateral aspect of the coracoid
- pierce the anterior fibers of the deltoid and enter the joint in the interval between the SS and subscapularis

4 Place lateral portal

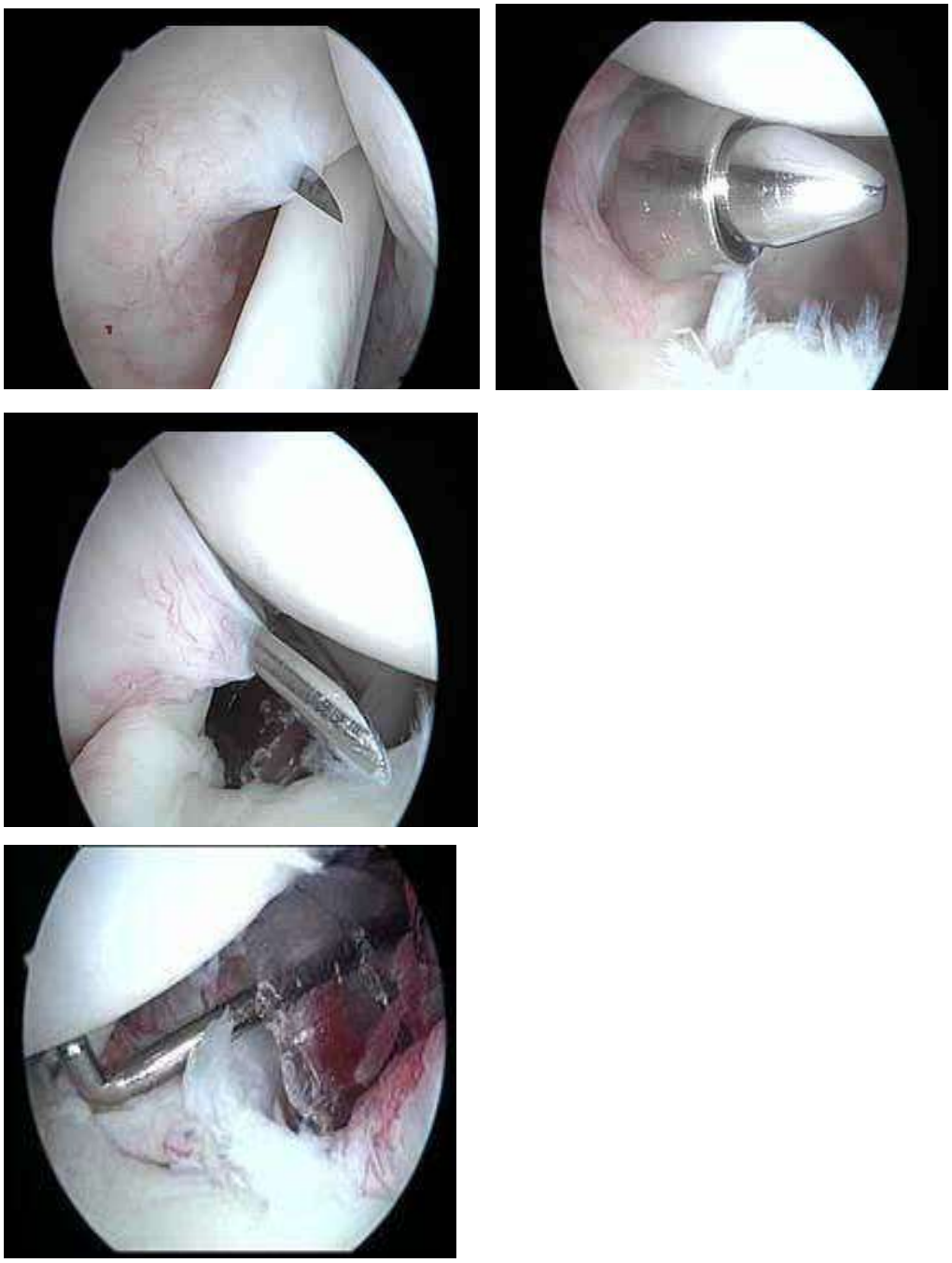
- place laterally in line with the mid clavicle and 2 to 3 cm lateral to its lateral edge

5 Place posterorlateral portal

- 1 cm distal to the posterolateral corner of the acromium

6 Place Nevias portal

- superomedial portal bordered by the clavicle the acromioclavicular joint and the spine of the scapula



PICTURE 7: DEVELOPING ARTHROSCOPIC PORTALS

Diagnostic Arthroscopy and Intra-articular Debridement

1 Visualize the anatomy

- articular cartridge of the humeral head and glenoid
- labrum
- biceps tendon
- inferior recess
- articular surface
- insertion of the subscapularis, SS, IS and TM

2 Establish anterior portal

- localize portal with an 18 gauge spinal needle placement
- place a seven minute millimetre cannula using the outside-in technique

3 Debride tissues

- place a 4.5 mm for radius shaver in anterior portal for intraarticular debridement
- debride degenerative labral tears, synovitis and cartilage lesions

Subacromial Bursectomy +/- Acromioplasty

1 Move trocar

- move the arthroscope to the subacromial space
- slide the trocar under the acromium over the posterior rotator cuff
- sweep under the acromium through the lateral gutter to break up adhesions

2 Identify the coracoacromial ligament

- found on the anterior aspect of the subacromial space

3 Create a lateral working portal

- localize portal with spinal needle through the deltoid
- insert 8.25 mm threaded cannula into lateral portal

4 Perform bursectomy

- use a 4.5 mm barrel shaped burr through the lateral portal
- use the full radial shaver to perform a complete bursectomy
- remove remaining bursa and soft tissue from the under surface of the acromion with a radiofrequency ablation wand.
- examine the anterior aspect of the acromium and cc ligament for signs of impingement

5 Perform acromioplasty

- partially resect the cc ligament with the ablation wand to expose the entire acromium
- start the acromioplasty at the anterior lateral corner and remove 5 to 8 mm of bone
- carry the resection medially to the AC joint

- make the resection level by sweeping the burr from anterior to posterior
- move the arthroscope to the lateral portal place and place burr in the posterior portal
- sweep the bird from a medial to lateral direction

Cuff Mobilization, Preparation of Tendon and Tuberosity

1 Tendon Debridement

- place the arthroscope in the posterolateral portal and the instruments in the lateral portal
- debride the tendon with an arthroscopic basket resector or a full radius shaver
- clear the remaining soft tissue with a radiofrequency ablation wand

2 Footprint Preparation

- use shaver to remove soft tissue from the greater tuberosity
- make sure to expose the cortical bone

Marginal Convergence Sutures

1 Pass sutures through margins of tear

- use a sharp suture passing instrument loaded with a high tensile strength free suture through the anterior portal to penetrate the anterior leaf of the tear
- use a second suture passing instrument from the posterior portal to penetrate the posterior leaf of the tear

2 Tie knot

- pass the free suture from the anterior instrument to the posterior instrument
- pull through the posterior portal
- take both limbs of the suture and pass them through lateral portal to tie and complete the marginal convergence stitch
- this is used and L reverse L and U-shaped tears to reduce the amount of strain on the tendon at the tuberosity repair and reduce the size of the tear

Anchor Placement, Suture Passage and Definitive Knots

1 Place anchors

- place 2 or 3 medial anchors at the level of the anatomic neck

- separate each anchor by 1 to 1.5 cm
- make small stab incisions just off the lateral border of the acromion
- place 2 or 3 medial anchors at the level of the anatomic neck

2 Pass sutures

- pass sutures from the medial row of anchors through the tendon
- start with the most anterior anchor
- pass both strands of one suture through the anterior aspect of the tear in a horizontal mattress manner
- pass sutures 1 cm medial to the lateral aspect of the tear
- pass one strand of the second suture next to the most posterior strand o of the first suture
- repeat steps for the posterior anchor of the medial row
- pass two strands of one suture through the posterior aspect of the tear.
- place one strand of the second suture anterior to the previously placed mattress suture and retrieve through the anterolateral portal
- retrieve both strands of the posterior mattress stitch out of the lateral portal
- tie arthroscopically and cut
- tie the remaining strands that have been passed through the tendon together
- tie oustide the shoulder through anterolateral portal
- cut the tails and advance the knot into the shoulder
- this is done by pulling on the opposite strands of the two sutures

3 Place a single lateral suture anchor

- place anchor on the lateral aspect of the rotator cuff footprint on the greater tuberosity halfway between the medial anchors
- retrieve one strand of one suture and pass it medial to the horizontal stitch between the anterior and posterior medial anchors
- repeat step with second suture from lateral anchor

4 Tie knots

- pull on the remaining medial sutures to tension the horizontal mattress stitch while the lateral row sutures are tied

- retrieve the remaining two strands of the medial row anchors out of the lateral portal and tie

Wound Closure, Confirm Repair and Address Intraoperative Complications

1 Irrigation, hemostasis, and drain

- irrigate the portals

2 Deep closure

- use 3-0 biosyn for closure

3 Superficial closure

- use 4-0 biosyn for skin

4 Dressing and immediate immobilization

- place sling

POST OPERATIVE MANAGEMENT

All arthroscopic rotator cuff repairs were performed on an outpatient basis. Following the procedure, the operated arm was placed at the side in a sling. The sling was worn continuously for 6 weeks, except during bathing and exercises.

The standard postoperative rehabilitation program is summarized below. However, if a subscapularis repair is performed, passive external rotation is limited to 0 degrees (i.e., straight ahead) for the first 6 weeks. In addition, terminal extension of the elbow is restricted if a biceps tenodesis was performed.

Rehabilitation Protocol Following Arthroscopic Rotator Cuff Repair

0-6 wks – immobilization : sling
Elbow/wrist: active ROM
Shoulder: passive external rotation in adduction only

6-12 wks- Shoulder: active ROM, avoid lateral abduction
Stretching: forward flexion, internal rotation, external rotation

>12 wks- Strengthening: deltoid, biceps, triceps, rotator cuff, scapular stabilizers

>6 mnths- Normal activities

POST OP XRAY

PICTURE 8: POST OP XRAY OF PATIENT

OBSERVATION AND RESULTS

The following observations were made from the data collected during study “to determine shoulder function after arthroscopic rotator cuff repair” in the department of Orthopaedics, DMC&H, Ludhiana. All the patients operated in DMC & H from Jan 2017 to May 2020 were included in the study and were followed up for a period of 6 months.

AGE DISTRIBUTION

TABLE 1: AGE DISTRIBUTION

AGE	No. of cases	Percentage
< 40	7	18.9%
41-50	8	21.6%
51-60	17	45.9%
> 60	5	13.5%
Total	37	100.0%

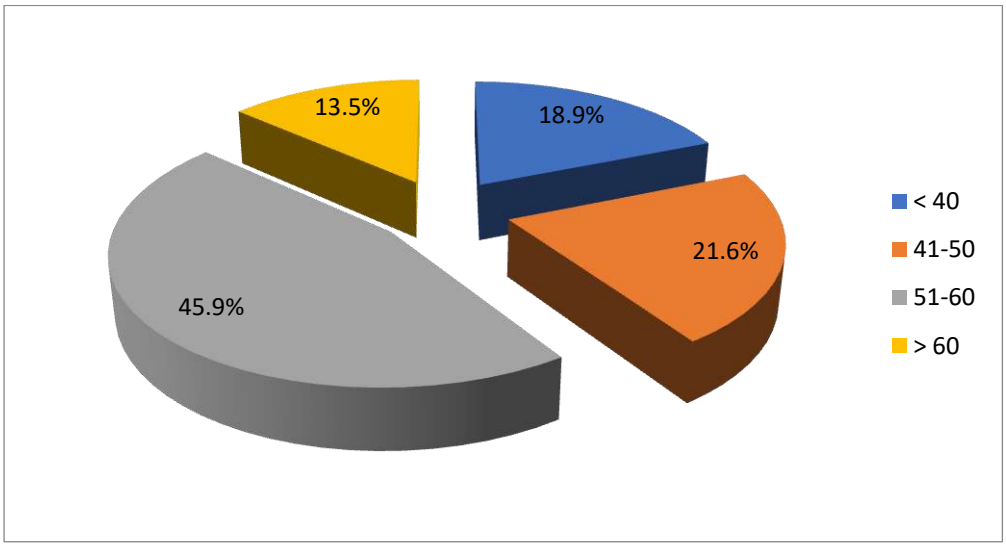


FIG 1: AGE DISTRIBUTION

Majority of the patients were in age group of 51-60 years.

Mean age was 51.46 with SD OF 9.42

SEX DISTRIBUTION

TABLE 2: SEX DISTRIBUTION

SEX	No. of cases	Percentage
FEMALE	17	45.9%
MALE	20	54.1%
Total	37	100.0%

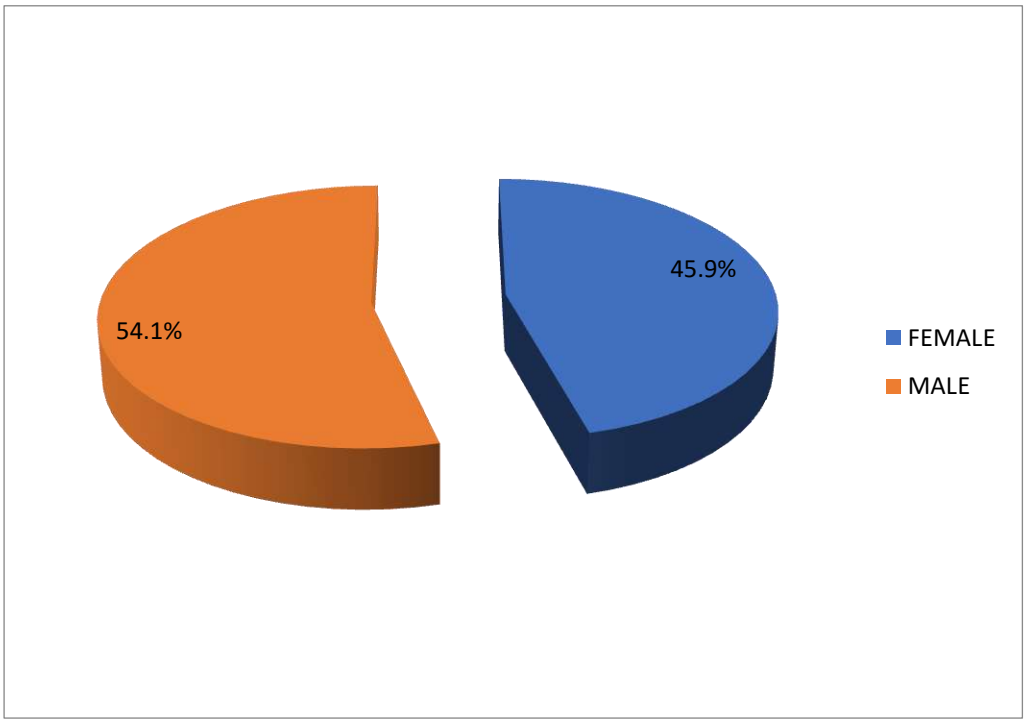


FIG 2: SEX DISTRIBUTION

Males (54.1%) were slightly more in number than females

MECHANISM OF INJURY

TABLE 3: MECHANISM OF INJURY

MECHANISM OF INJURY	No. of cases	Percentage
DOMESTIC FALL	28	75.7%
ROAD SIDE ACCIDENT	6	16.2%
SPORTS INJURY	1	2.7%
SUDDEN JERK WHILE WORKING	2	5.4%
Total	37	100.0%

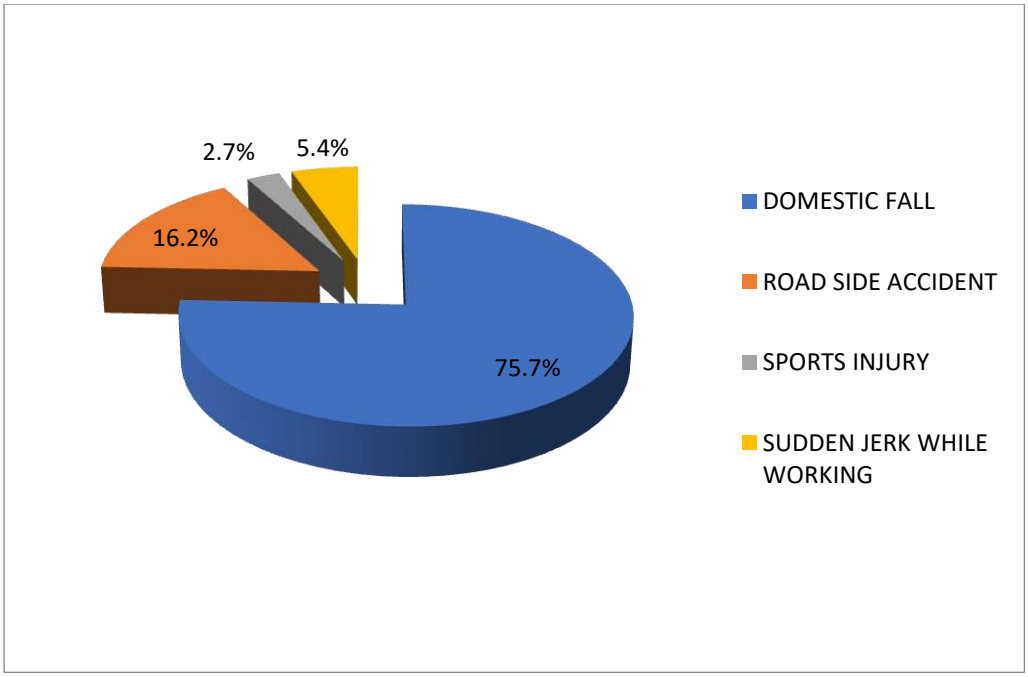


FIG 3: MECHANISM OF INJURY

Majority of the cases were because of domestic fall at home (75.7%)

SIDE INVOLVED

TABLE 4: SIDE INVOLVED

SIDE INVOLVED	No. of cases	Percentage
RIGHT	30	81.1%
LEFT	7	18.9%
Total	37	100.0%

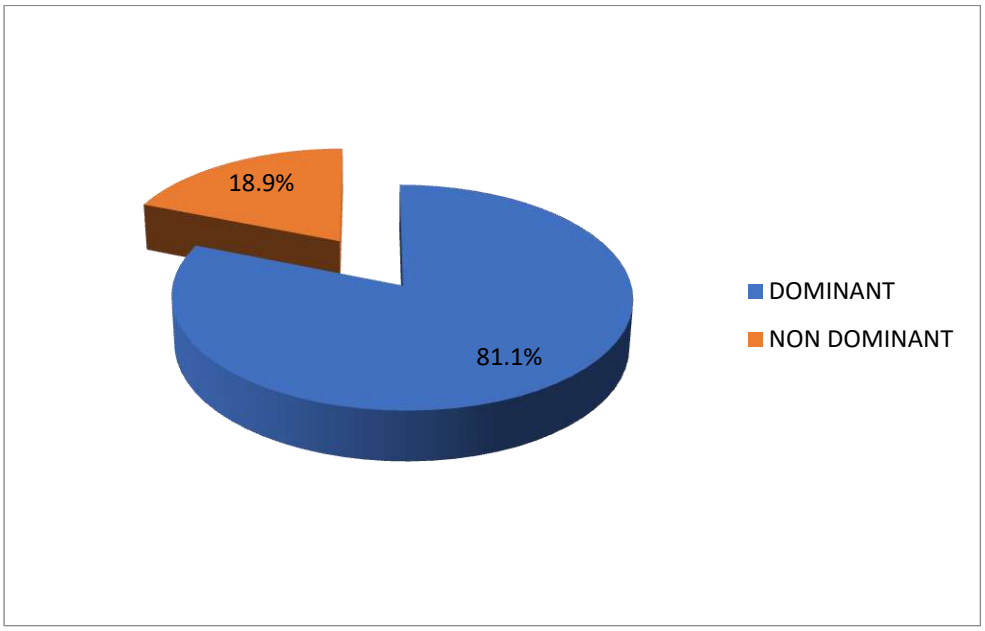


FIG: 4 SIDE INVOLVED

All the patients in our study were right handed. 30 patients (81.1%) had their dominant (right) shoulder involved while 7 (18.9%) had non dominant side involved.

DISTRIBUTION OF TYPE OF TEAR PRESENT

TABLE 5: DISTRIBUTION OF TYPE OF TEAR

DIAGNOSIS	No. of cases	Percentage
FULL THICKNESS	33	89.2%
PARTIAL THICKNESS	4	10.8%
Total	37	100.0%

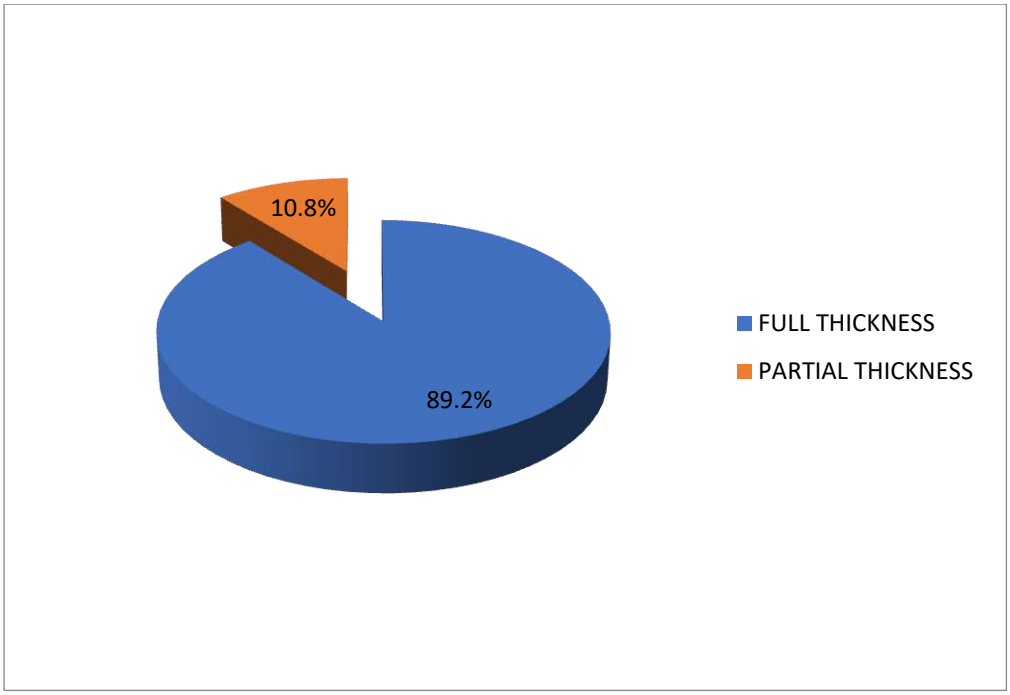


FIG 5: DISTRIBUTION OF TYPE OF TEAR

Majority of the cases operated were full thickness tears.

NUMBER OF ANCHOR SUTURES USED

TABLE 6: NUMBER OF ANCHOR SUTURES USED

NUMBER OF ANCHORS USED	No. of cases	Percentage
2 ANCHORS	23	62.2%
3 ANCHORS	4	10.8%
1 ANCHOR	10	27.0%
Total	37	100.00%

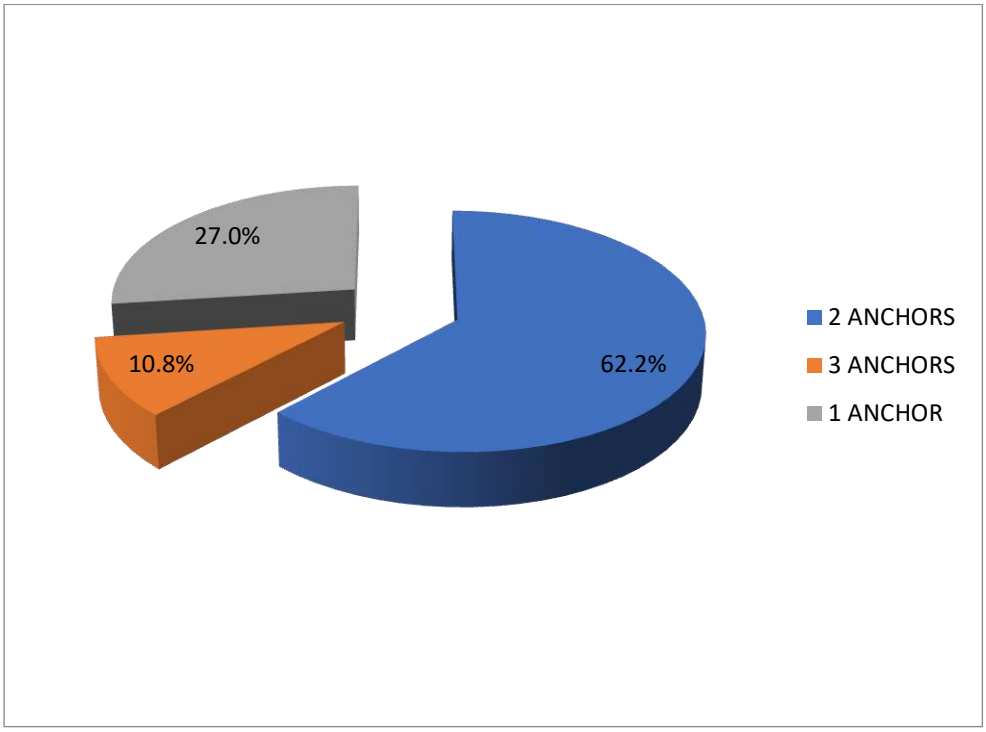


FIG 6: NUMBER OF ANCHOR SUTURES USED

In 23 patients (62.2%) 2 anchor sutures were used, in 10 patients single anchor suture was used. A mean of 1.71 anchors for single row and 2.08 anchors for double row were used in our study

DISTRIBUTION OF TECHNIQUE USED

TABLE 7: DISTRIBUTION OF TECHNIQUE USED

TECHNIQUE USED	No. of cases	Percentage
Single row	24	64.9%
Double row	13	35.1%
Total	37	100.0%

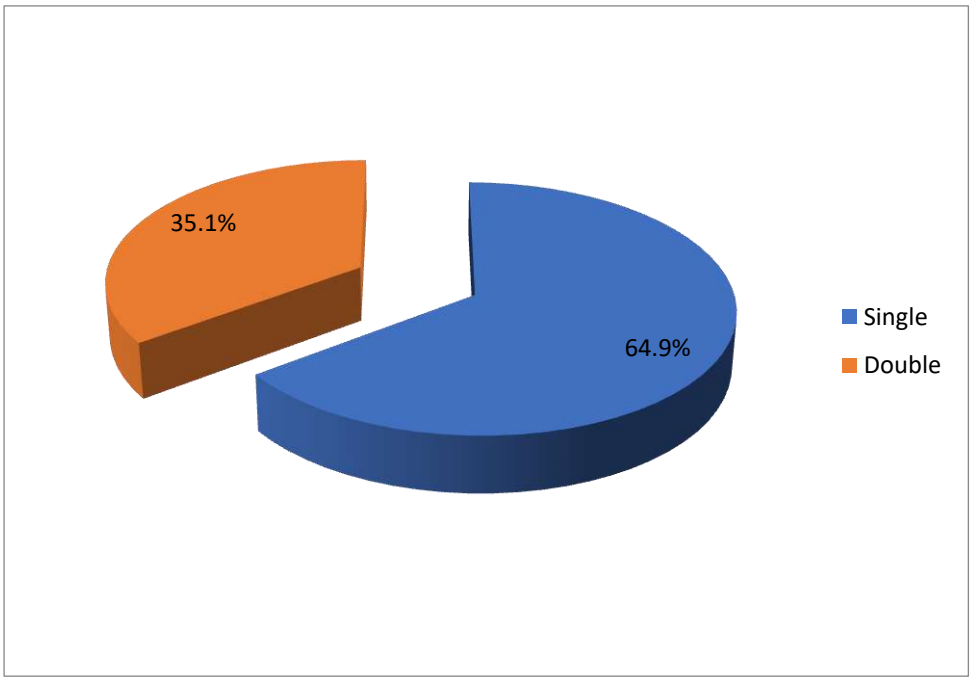


FIG 7: DISTRIBUTION OF TECHNIQUE USED

Majority of the cases were done with single row technique (64.9%)

DISTRIBUTION OF SPECIAL TESTS PERFORMED ON THE PATIENT

TABLE 8.A: FOR SUPRASPINATUS

SUPRASPINATUS EMPTY CAN TEST (JOBE TEST)	No. of cases	Percentage
POSITIVE	37	100.0%

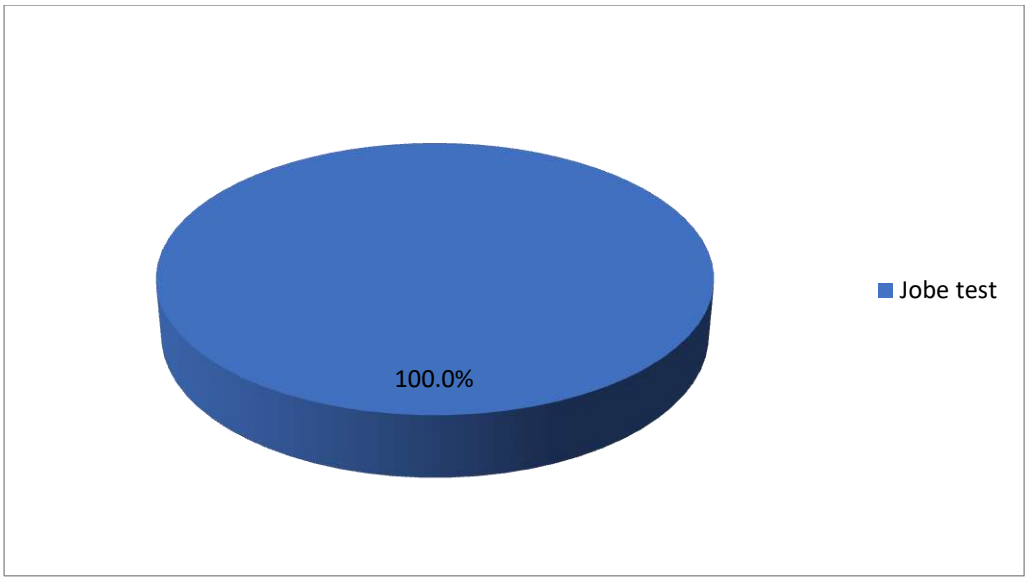


FIG 8.A FOR SUPRASPINATUS

All the patients had supraspiatus muscle involvement.

TABLE 8.B: FOR INFRASPINATUS

INFRASPINATUS DROP SIGN	No. of cases	Percentage
NEGATIVE	21	56.8%
POSITIVE	16	43.2%
Total	37	100.0%

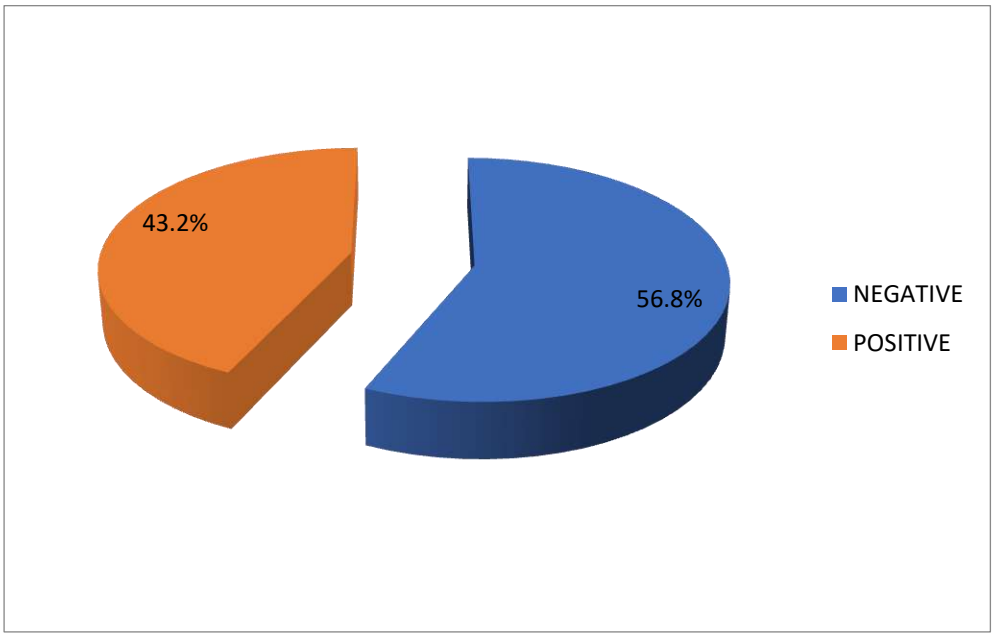


FIG 8.B: FOR INFRASPINATUS

TABLE 8.C: FOR SUBSCAPULARIS

SUBSCAPULARIS LIFT OFF TEST	No. of cases	Percentage
NEGATIVE	19	51.4%
POSITIVE	18	48.6%
Total	37	100.0%

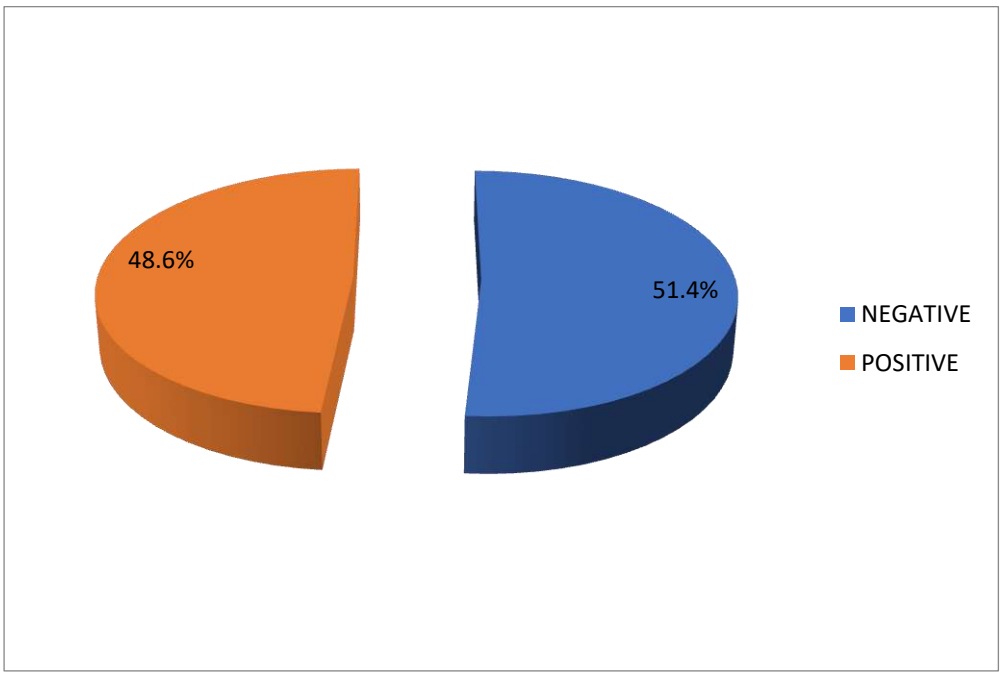


FIG 8.C: FOR SUBSCAPULARIS

TABLE 8.D: FOR TERES MINOR

TERES MINOR EXTERNAL ROTATION STRESS TEST	No. of cases	Percentage
NEGATIVE	30	81.1%
POSITIVE	7	18.9%
Total	37	100.0%

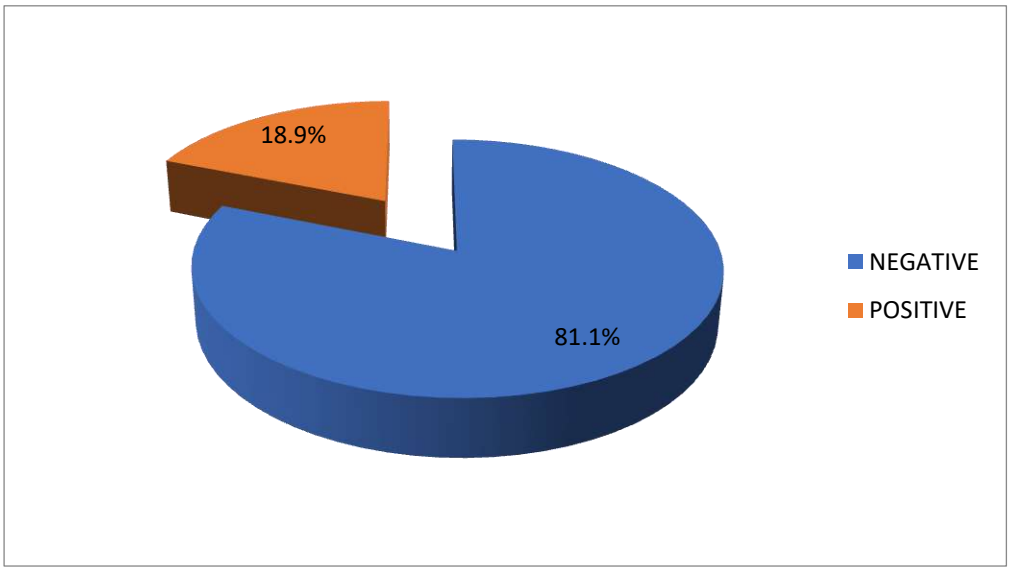


FIG 8.D: FOR TERES MINOR

TABLE: 9 POST OPERATIVE COMPLICATIONS

	NUMBER OF CASES (follow up at 3 weeks)	PERCENTAGE
NERVE INJURY	0	0%
INFECTION	0	0%
STIFFNESS	20	54%
INFLAMMATORY REACTION	25	67.5%
OSTEOARTHRITIS	0	0%

Out of 37 patients, 20 patients had shoulder stiffness while 25 patients had redness (inflammation) post operatively. No case of retear was noted at the end of our study. This can be attributed to limited sample size, shorter duration of follow up and also to the surgical technique used

DISTRIBUTION OF PAIN SCORE

TABLE 10: DISTRIBUTION OF PAIN SCORE

	Mean	Std. Deviation	t	p-value	Difference	
					Mean	SD
Pain_0 Month	2.54	1.22				
Pain_1 Month	5.95	0.33	-15.669	0.000	-3.41	1.32
Pain_6 Months	8.22	0.63	-27.654	0.000	-5.68	1.25

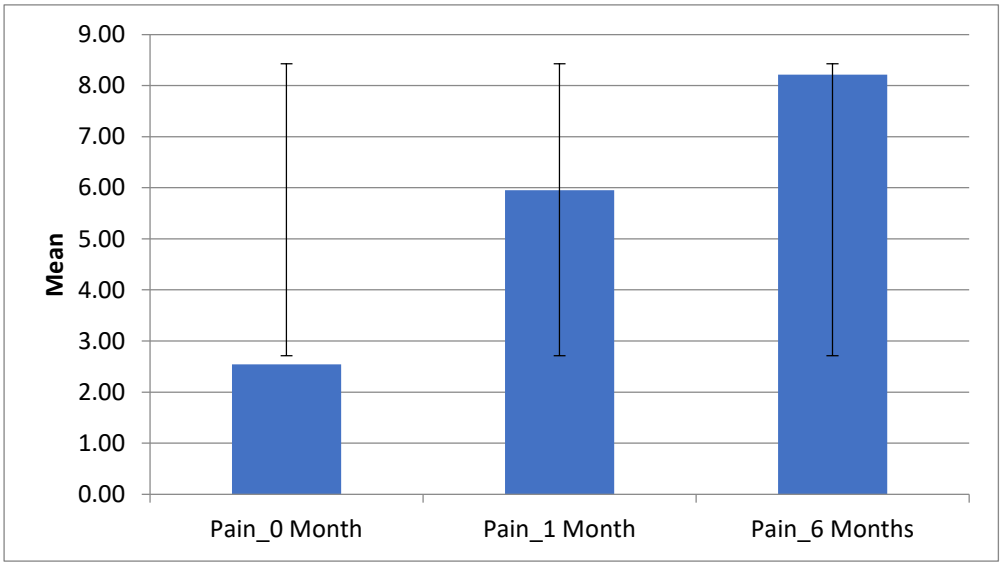


FIG 9: DISTRIBUTION OF PAIN SCORE

Mean pain score was 8.22 out of 10 at the end of follow up. 33(89.1%) patients had occasional and slight pain while 4 (10.9%) were pain free

DISTRIBUTION OF FUNCTION SCORE

TABLE 11: DISTRIBUTION OF FUNCTION SCORE

	Mean	Std. Deviation	t	p-value	Difference	
					Mean	SD
Function_ 0 Month	2.95	1.37				
Function_ 1 Month	5.46	1.54	-7.774	0.000	-2.51	1.97
Function_ 6 Months	8.16	0.73	-22.090	0.000	-5.22	1.44

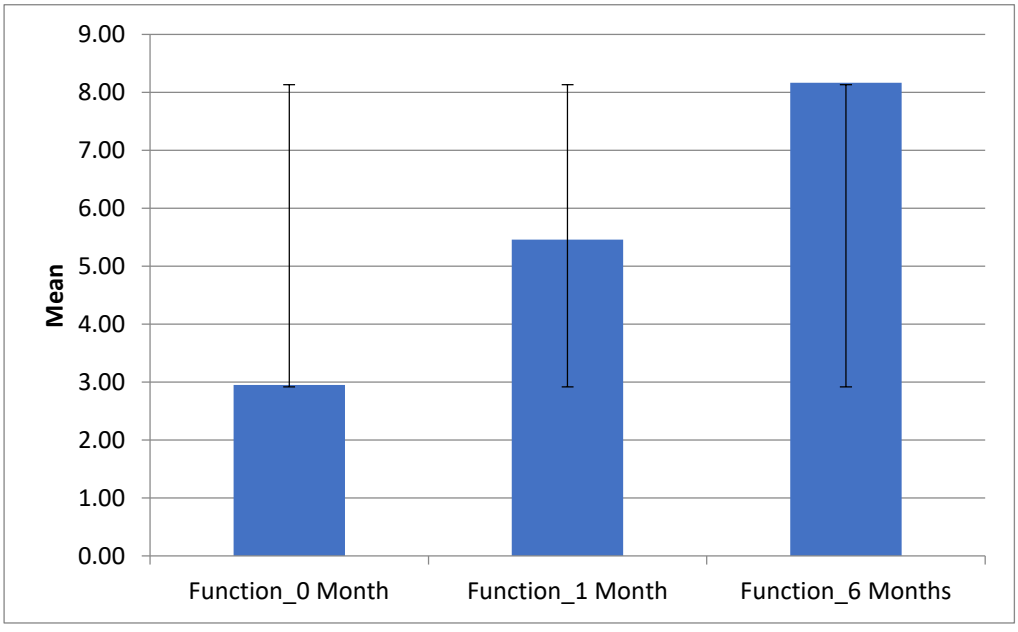


FIG 10: DISTRIBUTION OF FUNCTION SCORE

Mean function score was 8.16 out of 10 at the end of follow up. 33 (89.1%) had slight restriction and were able to do work above shoulder level while 4 (10.9%) patients were able to do normal activities

DISTRIBUTION OF ACTIVE FORWARD FLEXION SCORE

TABLE 12: DISTRIBUTION OF ACTIVE FORWARD FLEXION SCORE

	Mean	Std. Deviation	t	p-value	Difference	
					Mean	SD
Active forward flexion_0 Month	1.81	0.81				
Active forward flexion_ 1 Month	3.00	0.00	-8.920	0.000	-1.19	0.81
Active forward flexion_6 Months	4.43	0.56	-23.411	0.000	-2.62	0.68

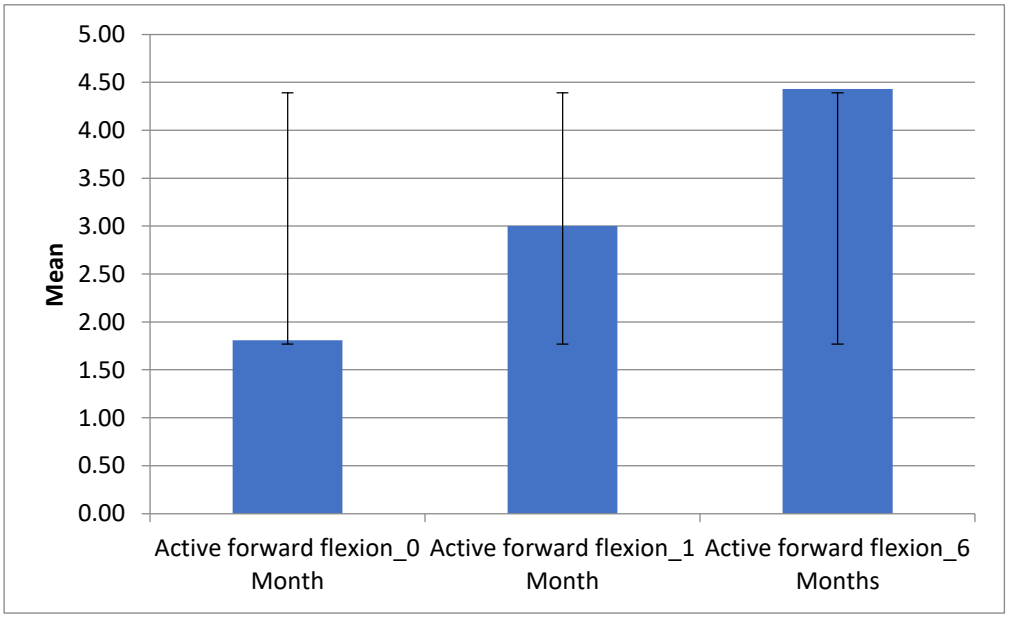


FIG 11: DISTRIBUTION OF ACTIVE FORWARD FLEXION SCORE

Mean active forward flexion score was 4.43 out of 5 at the end of follow up. 19 (51.3%) patients were able to do forward flexion between 120 to 150 degrees while 17 patients were able to do 150 degrees or more flexion.

DISTRIBUTION OF STRENGTH OF FORWARD FLEXION SCORE

TABLE 13: DISTRIBUTION OF STRENGTH OF FORWARD FLEXION SCORE

	Mean	Std. Deviation	t	p-value	Difference	
					Mean	SD
Strngth of forward flexion_0 Month	3.03	0.55				
Strngth of forward flexion_ 1 Month	3.49	0.51	-3.643	0.001	-0.46	0.77
Strngth of forward flexion_6 Months	4.57	0.56	-18.548	0.000	-1.54	0.51

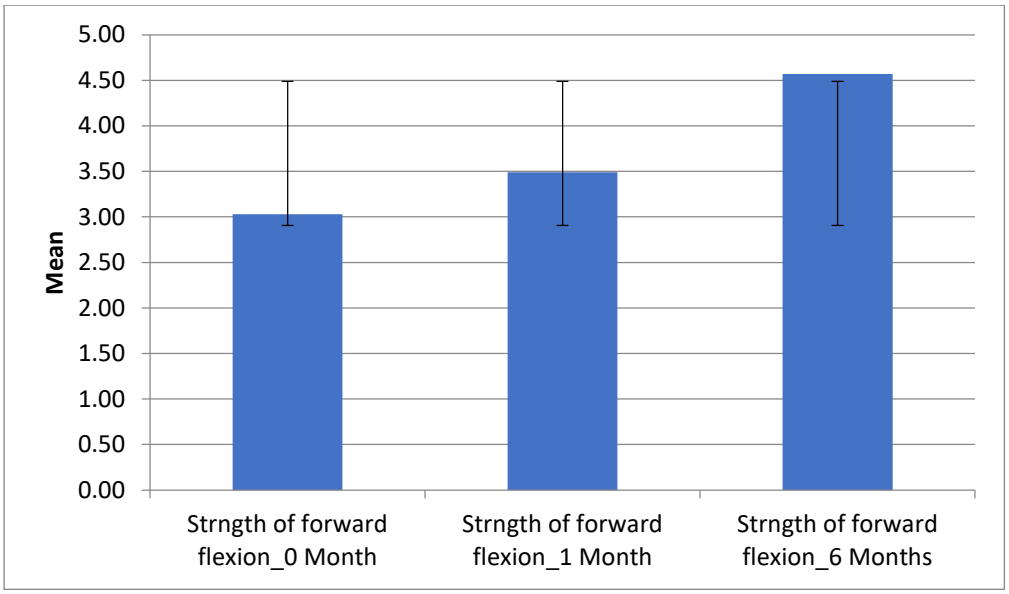


FIG 12: DISTRIBUTION OF STRENGTH OF FORWARD FLEXION SCORE

Mean strength of forward flexion was 4.57 out of 5 at the end of follow up. 21 (56.7%) patients had normal strength (grade 5), 14 (37.8%) had grade 4 strength while 2 (5.4%) had grade 3 strength at the end of follow up.

DISTRIBUTION OF SATISFACTION SCORE

TABLE 14: DISTRIBUTION OF SATISFACTION SCORE

	Mean	Std. Deviation	t	p-value	Difference	
					Mean	SD
Satisfaction of patient_ 0 Month	0.00	0.00				
Satisfaction of patient_ 1 Month	3.92	2.09	-11.424	0.000	-3.92	2.09
Satisfaction of patient_ 6 Months	5.00	0.00				

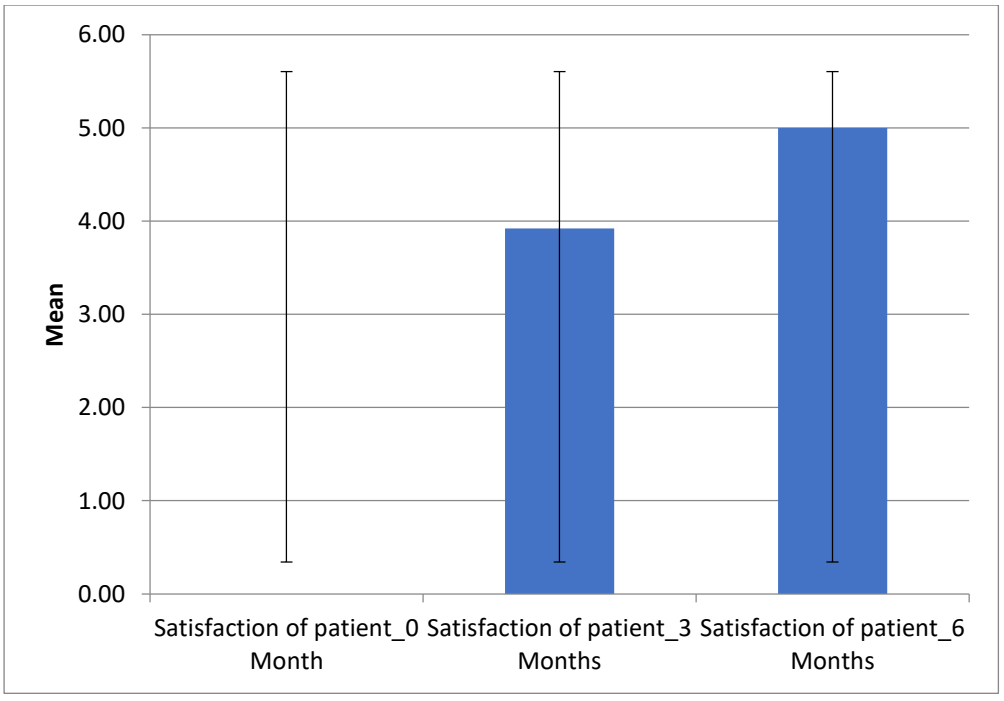


FIG 13: DISTRIBUTION OF SATISFACTION SCORE

Mean satisfaction score was 5 out of 5 at the end of follow up (100%)

DISTRIBUTION OF TOTAL UCLA SCORE

TABLE 15: DISTRIBUTION OF TOTAL UCLA SCORE

	Mean	Std. Deviation	t	p-value	Difference	
					Mean	SD
Total score_0 Month	10.27	3.09				
Total score_ 1 Month	21.59	2.33	-16.733	0.000	-11.32	4.12
Total score_6 Months	30.41	1.52	-45.372	0.000	-20.14	2.70

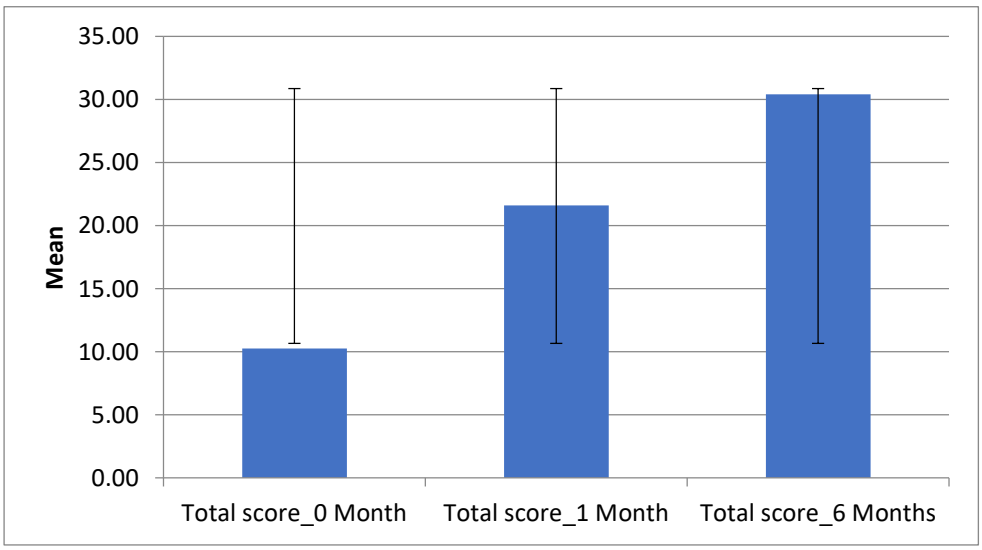


FIG 14: DISTRIBUTION OF TOTAL UCLA SCORE

The total mean UCLA score was 30.41 out of 35 at the end of follow up. 36 patients came in the category of good result (score between 28-33) while 1 patient had excellent result (scoring 35 out of 35).

COMPARISON OF ULCA SCORE ACCORDING TO TYPE OF TEAR

TABLE 16: COMPARISON OF ULCA SCORE ACCORDING TO TYPE OF TEAR

Row	Single		Double		t	p-value
	Mean	SD	Mean	SD		
Total score_0 Month	11.25	2.67	8.46	3.07	2.875	0.007
Total score_ 1 Month	21.29	2.16	22.15	2.61	-1.078	0.288
Total score_6 Months	30.46	1.32	30.31	1.89	0.285	0.778

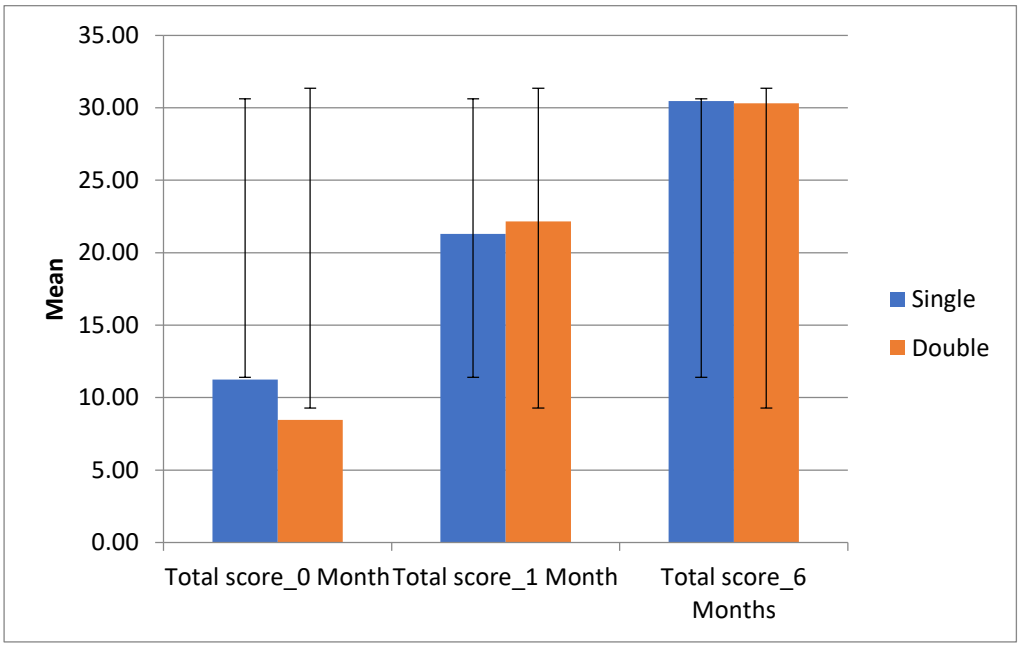


FIG 15: COMPARISON OF ULCA SCORE ACCORDING TO TYPE OF TEAR

Mean UCLA score of 30.46 out of 35 for patients who underwent single row technique (24 out of 37) while 13 patients who underwent double row technique have mean UCLA score of 30.31 out of 35. There was no statistically significant difference between these two techniques.

DISCUSSION

The present study enrolled a total of 37 patients with rotator cuff tear. All the patients were followed up for 6 months postoperatively. Complete data of thirty-seven patients was available for compilation of results and analysis. Majority of the patients were in the age group of 51-60 years with a mean age of 51.46 years (27-67). In a study of 40 patients who underwent arthroscopic RCR by both single and double row techniques by Burks et al[42], the mean age was 56.5 years. In a study of 65 patients conducted by Boileau et al[12], all were diagnosed with chronic supraspinatus tears and were treated with arthroscopic rotator cuff repair, the mean age was 60 years with equal distribution of males and females. The mean age of 60 years was being documented in a study by Kim et al[43] who underwent arthroscopic RCR surgery. The patients with degenerative rotator cuff changes (atraumatic) were more in number in these studies. We observed in our study that the majority of the patients were in the fourth and fifth decade of their life. Based on the history, the tear was thought to be associated with some degree of trauma. Around 75% of the cases were due to domestic fall followed by roadside accident cases (16.7%). We found no statistical significance between the age of the patient and postoperative results.

We found in our study that 54.1 % were males as compared to 45.9% females. In a similar study conducted by frencheschi et al[44], more than 50 % (57.1%) were females. Almost similar results were found in the study of Boileau et al[12] with 50.7 % of females. Sugaya et al[13] conducted a study to evaluate Repair Integrity and Functional Outcome After Arthroscopic Double-Row RCR included 60.4 % of males which is similar to our study. Increasing male cases in our study can be due to cases caused by roadside accidents, sports injuries apart from domestic fall at home but there is no statistical difference in functional outcome based on gender of the patient.

Among 37 patients, 30 (81.1%) patients had their dominant shoulder involved, rest 7 (18.9%) patients had non dominant involved. Among 42 patients in a study by frencheschi et al[44], 39 (92.8) had their

dominant side involved, rest 3 (7.2%) had non dominant shoulder involved. In a study of 63 patients by miyazaki et al[15], 87.3 % (55 out of 63) had their dominant side involved. This is similar to our study.

Most common cause of rotator cuff injury in our study was domestic fall 75.7% followed by roadside accidents. Miyazaki et al[15] conducted a study on 63 patients aged under 50 years also found the majority of the patients with traumatic etiology. Twenty-five out of forty patients suffered antecedent trauma in a study by Burks et al[42]. 45 percent of the cases of arthroscopic rotator cuff repair in the study of Boileau et al[12] were traumatic. Our study suggests trauma being the leading cause of patients undergoing rotator cuff surgery (irrespective of age) as a result of acute onset of pain and near-complete loss of function of the limb. All the females who underwent the surgery were housewives and were unable to carry out their daily household chores.

Almost all the cases were diagnosed with complete thickness rotator cuff tears (89.2%) and rest (4 out of 37) patients with high-grade partial-thickness tears. Studies conducted by Boileau et al, Burks et al, Sugaya et al only included complete rotator cuff tears. While a similar study conducted by Chung et al[45] included patients who had 34 cases of high-grade partial thickness tears and 21 cases with full-thickness tears. Partial-thickness tears are reported to be approximately twice as common as full-thickness tears, may increase in size or progress to full-thickness tears if left untreated. Our study can't be comparable to these studies as it is impossible to perform any valid analysis on whether partial or complete thickness tear is a significant factor influencing the outcome.

In 23 patients (62.2%) 2 anchor sutures were used, in 10 patients single anchor suture and in 4 patients 3 anchor sutures were used. The two suture strands tied together using a Duncun Loop sliding locking knot and the knot reinforced with 4-5 reversing half hitch knots. A mean of 1.71 anchors for single row and 2.08 anchors for double row were used in our study. The single anchor sutures were used for small tears while two and three anchor sutures were used in medium to large tears. The number of anchors used in our study, are not that high. In

fact, in the paper by Franceschi et al[44], who included only large or massive tears in their comparisons,1.9 anchors were used for the single row and 2.3 anchors for the double row. This is actually a greater number of anchors than was used in our study, which evaluated tears that were thought to be mainly medium to large in size. Sugaya et al[13] used on average 2.4 anchors for single row and 3.2 anchors for the double row. Anderson et al[46] used 1.2 anchors for the medial row and 1.6 anchors for the lateral row. According to Huijsmans et al[47] in the majority of the cases no more than 2 or 3 anchors for a standard double row repair are required. The number of sutures used per anchor can be a confounding factor. Increasing the number of sutures per anchor can significantly increase the holding strength. We found that correct placement of suture anchors, using more sutures per anchor, performing bursectomy from the under surface of acromian and acromioplasty done very carefully yielded promising results. Yet patients presented with stiffness over shoulder (20 out of 37) and redness over operated area (25 out of 37) post operatively. No major complication like nerve injury was noted.

Following is the comparison with other studies in view of parameters of UCLA SCORE:-

Author name	Study duration	Preoperative pain score	Follow up pain score	P value
Boileau et al[12]	29 months	2.1 $\pm$1.2	9.1 $\pm$1.7	<0.001
Sugaya et al[13]	31 months	2.4 $\pm$1.5	9.3 $\pm$1.2	<0.001
Murray et al[5]	24 months	3.4 $\pm$ 1.6	9.3 $\pm$1.4	<0.001
Our study	6 months	2.54 $\pm$1.2	8.22$\pm$0.63	<0.001

Author name	Study duration	Preoperative function score	Follow up function score	P value
Boileau et al[12]	29 months	2.6 ±1.2	9.1 ±1.7	<0.001
Sugaya et al[13]	31 months	4.6 ±2.0	9.1 ±1.3	<0.001
Murray et al[5]	24 months	5.4 ± 1.3	9.5 ±1.1	<0.001
Our study	6 months	2.95 ±1.4	8.16 ±0.73	<0.001

Author name	Study duration	Preoperative active forward flexion score	Follow up active forward flexion score	P value
Boileau et al[12]	29 months	4.5 ±0.9	4.9 ±0.5	<0.001
Sugaya et al[13]	31 months	4.1 ±1.1	5.0 ±0	<0.001
Murray et al[5]	24 months	4.7 ± 0.9	5.1 ±0.7	0.026
Our study	6 months	1.81 ±0.8	4.43 ±0.6	<0.001

Author name	Study duration	Preoperative strength score	Follow up strength score	P value
Boileau et al[12]	29 months	2.3 $\pm$0.5	4.4 $\pm$0.7	<0.001
Sugaya et al[13]	31 months	3.3 $\pm$1.3	4.8 $\pm$0.5	<0.001
Murray et al[5]	24 months	3.8 $\pm$ 0.7	4.9 $\pm$0.4	<0.001
Our study	6 months	3.03 $\pm$0.5	4.57 $\pm$0.6	<0.001

Regarding pre-operative pain, among 37 patients, 15 (40.5%) patients presented with unbearable pain and need for occasional strong medication while 14 (37.8%) patients had pain on performing only light activities with frequent use of salicylates. All the patients were not able to drive, do most of household work, dress and undress by themselves pre operatively. Around 57% (21 patients) cases were to do active forward flexion by 45-90 degrees while only 16 % (6 patients) were able to do 90-120 degrees of forward flexion preoperatively. These findings were similar to studies conducted by Boileau et al[12], Sugaya et al[13] and Murray et al[5] except in these studies active forward flexion in most of the cases is between 120-150 degrees. This along with poor scores pre operatively can be attributed to the late presentation due to many reasons like lack of awareness about the problem and its surgical correction, apprehension about the disability and the procedure too, financial issues, difficulty of accessing tertiary health care centre and ignorance.

On examination every patient had Jobe's test positive with the involvement of supraspinatus tendon in all cases and the result of pain in all the patients. In our study, we found that clinical examination played a key role in screening as well as diagnosing rotator cuff tears. Positive clinical tests correlated with MRI findings that were positive in all patients. So, the surgeon may not depend on radiological investigation only as it lowers the financial burden on healthcare

system and the patient too.

Though the follow up period was smaller as compared to other studies we were able to achieve comparable results in view of pain, function, range of motion and strength as well as statistically significant data in all these parameters. The mean pain score at the end of follow up was greater than 8 (8.22) that means patients no longer require frequent use of pain killers and pain was just occasional and slight in majority of the cases which is similar to other studies. The mean function score at the end of study was also more than 8 (8.16) that means all the patients can do most of the housework, shopping and driving is possible and are able to work above the shoulder level. The active forward flexion in majority of the cases (51.3%) was between 120 to 150 degrees (score increased from 1.81 to 4.43) which is clinically as well as statistically significant result. The ease of life with ability to perform normal functioning of the limb was the goal of the surgery and our study.

This can be due to our technical expertise and the strict rehabilitation protocol employed on the patients. Patients were advised to use shoulder abduction sling for the initial 3-6 weeks along with active wrist and elbow range of motion followed by active shoulder range of motion (avoiding abduction initially) at 6-12 weeks post-op. Patients were taught stretching exercises for forward flexion, internal and external rotation. Lastly, deltoid, rotator cuff, biceps, and triceps strengthening exercises were started which were continued till the end of the study and this showed excellent results in our patients. The operative technique used combined with strict physiotherapy was the prime basis of our study and all the patients were compliant enough to yield good results. No doubt the satisfaction parameter of UCLA score at the end of our study is 100%.

On analysing the final outcome, our mean UCLA score at the end of our study was calculated to be 30.41 which can be graded a good result. All the patients have shown satisfactory results (36 out of 37 shown good result with score between 28-33, while 1 patient shown excellent result with score more than 33)

Following is the comparison of mean UCLA score with other studies:

Author name	Technique used	Number of patients	Mean age	Follow up duration	Mean UCLA at end of follow up
Sugaya et al[13]	Double row	86	60.5	31 months	32.9 ±3.7
Murray et al[5]	Not available	45	57.6	24 months	33.7±3.0
Ji et al[48]	Single row Double row	22 25	58 56	22 months 24 months	30.82 32.40
Burks et al [42]	Single row Double row	20 20	56 57	12 months 12 months	28.6±3.6 29.5±5.6
Franceschi et al[44]	Single row Double row	26 26	63.5 59.6	22.5 months 22.5 months	32.9(29-35) 33.3(30-35)
Boileau et al[12]	Tension band suture	65	60	29 months	32.3±1.3
Our study	Single row Double row	24 13	53.3 48.1	6 months 6 months	30.46±1.3 30.31 ± 1.9

Based on our study the initial UCLA score for patients who underwent single-row fixation (11.35) was more than those who underwent double-row fixation (8.5). At the end of 6 months the mean UCLA scores are 30.46 and 30.31 respectively. In this we have analysed the rotator cuff tears depending on technique and post-operative UCLA score. Though double row fixation proves to be a better technique in treating large rotator cuff repairs, we found no significance in outcome of patients treated by both techniques which was similar to other study results as shown in the table. The patients in the analysis were mostly in age group 51-60 which is also seen in our study group. Absence of any major complication and any retear in our study may be due to a short term follow up period of 6 months. The outcome may vary due to

technical expertise. We had a 0 % failure rate in our study which is close to other studies. No doubt further low failure rate in our study is likely due to technical expertise, surgical skills, patient selection and rehabilitation.

Limitation of our study is short term follow up and small study group. Presence of concomitant pathologies along with rotator cuff tear may affect the functional outcome of cuff repair which needs to be explored. In conclusion, arthroscopic rotator cuff repair results in good to excellent functional and clinical outcome of patients with rotator cuff tears.

SUMMARY

This was a prospective and retrospective study of 37 patients for evaluation of shoulder function after arthroscopic rotator cuff repair.

- Most patients were in the age group of 51-60 years with a mean age of 51.46 years
- 20 of the patients (54.1%) were males while 17 (45.9%) were females
- 30(81.1%) out of 37 patients had their dominant side involved
- Most common cause of rotator cuff tears was domestic fall (28 out of 37) followed by road side accidents (6 out of 37)
- 33(89.2%) cases were full thickness rotator cuff tears while 4 (10.8%) were partial thickness tears
- 24 out of 37(64.9%) cases were done via single row technique while 13(35.9 %) cases via double row technique
- In majority of the cases, 23 out of 37, 2 anchor sutures were used. In 10 patients single anchor suture was used, in rest 4 patients, 3 anchor sutures were used
- Single anchor suture were used for small thickness tears while two and three anchor sutures were used for medium to large thickness tears
- The mean suture anchors used for single row were 1.71 while for double row were 2.08
- Mean pre-operative UCLA score was 10.27 Post-operative follow up:
- Mean follow up period was 6 months
- None of the patients had episode of re-tear of rotator cuff
- 20 patients (54%) complained of stiffness and 25 (67.6%) complained of redness over shoulder post operatively
- 33 (89.1%) patients were complaining of occasional pain while doing heavy work while 4 (10.9%) were pain free with a mean pain score of 8.22 out of 10 at the end of follow up
- No major complication was noted at the end of our study.

- The mean post-operative UCLA score improved from 10.27 to 30.41
- No statistical difference found between functional outcome of double and single row technique
- With a mean forward flexion score of 4.43, majority of the patients (19 out of 37) had active forward flexion between 120 to 150 degrees.
- After 6 months, 36 patients had good result while 1 patient had excellent result
- The final functional outcome of arthroscopic rotator cuff repair was graded as Good based on UCLA shoulder scoring sheet.

CONCLUSION

We utilized UCLA scoring system for 37 patients which included parameters that determine the overall functioning of the limb as well as the satisfaction level of the patient. We employed a risk-reward analysis of patient age, functional demands, and other quality-of-life issues before deciding the surgical method. Relief of pain and ability to perform normal functioning of the limb was the goal of our study. The patients selected in our study had a history of precedent trauma and suffered from unbearable shoulder pain, requiring frequent medications, unable to use the limb and not able to work above shoulder level. There was a significant improvement in the mean pain score from 2.54 to 8.22 out of 10 ($p<0.001$) with 33 patients (89.1%) were just left with occasional pain while 4 (10.9%) patients were pain free. Mean function score improved from 2.95 to 8.16 out of 10 ($p<0.001$) with 33 patients (89.1%) were able to work above the shoulder level with slight restriction while 4(10.9%) patients were able to do normal activities without any restriction. Mean strength score improved from 3.03 to 4.57 out of 5 ($p<0.001$) with 21 (56.7%) patients had normal strength (grade 5), 14 (37.8%) had grade 4 strength while 2 (5.4%) had grade 3 strength at the end of follow up. All the patients were satisfied and better. Stiffness and redness were the early post-operative complications seen in more than 50% of patients but they also improved over a period of six months. No major complication like nerve injury, retear was seen in our study. The mean total UCLA score improved from 10.27 to 30.41 ($p<0.001$) which is graded as a good and satisfactory result according to UCLA scoring sheet. With a mean final follow up UCLA score of 30.31 in double row technique and 30.46 in single row technique used, we conclude that there was no statistical difference between both the techniques and they were equivalent to each other. Hence, we conclude from our study that arthroscopic repair of rotator cuff tears is a rewarding surgery in improving the pain and functioning of shoulder.

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S. NO	MRD	INITIALS	AGE	SEX	ADMISSION NO	DATE OF ADMISSION	MECHANISM OF INJURY	DIAGNOSIS	SIDE INVOLVED
1	227069	A	65	FEMALE	2017013443	3/22/2017	SUDDEN JERK WHILE WORKING	FULL THICKNESS SUPRASPINATUS TEAR	DOMINANT
2	231596	JK	65	FEMALE	2017020711	4/26/2017	DOMESTIC FALL	FULL THICKNESS SUPRASPINATUS TEAR LEFT SIDE	NON DOMINANT
3	272236	NK	55	FEMALE	2017026877	5/24/2017	DOMESTIC FALL	FULL THICKNESS TEAR SUPRASPINATUS RIGHT SIDE WITH SUBACROMIAL IMPINGEMENT	DOMINANT
4	290914	VK	50	MALE	2017032960	6/21/2017	DOMESTIC FALL	FULL THICKNESS TEAR SUPRASPINATUS RIGHT SIDE WITH SUBACROMIAL IMPINGEMENT	DOMINANT
5	294126	JS	58	MALE	2017034009	6/26/2017	DOMESTIC FALL	PARTIAL THICKNESS TEAR SUPRASPINATUS LEFT SIDE	NON DOMINANT
6	354430	JK	62	FEMALE	2017054653	9/22/2017	DOMESTIC FALL	FULL THICKNESS TEAR SUPRASPINATUS WITH PARTIAL THICKNESS TEAR INFRASPINATUS RIGHT SIDE	DOMINANT
7	44647	PK	55	FEMALE	2017068640	11/13/2017	DOMESTIC FALL	FULL THICKNESS TEAR SUPRASPINATUS WITH PARTIAL THICKNESS TEAR INFRASPINATUS RIGHT SIDE WITH TENDONOSIS OF SUBSCAPULARIS	DOMINANT
8	397343	B	47	MALE	2017072995	12/1/2017	DOMESTIC FALL	FULL THICKNESS TEAR SUPRASPINATUS RIGHT SIDE WITH SUBACROMIAL IMPINGEMENT	DOMINANT
9	436292	KK	54	FEMALE	2018014392	3/7/2018	DOMESTIC FALL	FULL THICKNESS TEAR SUPRASPINATUS WITH SUBACROMIAL IMPINGEMENT RIGHT SIDE	DOMINANT
10	415197	KK	50	FEMALE	2018020243	4/2/2018	DOMESTIC FALL	FULL THICKNESS TEAR SUPRASPINATUS WITH SUBACROMIAL IMPINGEMENT RIGHT SIDE	DOMINANT
11	496840	B	36	MALE	2018029144	5/11/2018	DOMESTIC FALL	PARTIAL THICKNESS SUPRASPINATUS LEFT SIDE	NON DOMINANT
12	535305	MK	37	FEMALE	2018044663	7/18/2018	DOMESTIC FALL	FULL THICKNESS TEAR SUPRASPINATUS LEFT SIDE	NON DOMINANT
13	534603	G	45	MALE	2018045666	7/22/2018	DOMESTIC FALL	FULL THICKNESS TEAR SUPRASPINATUS WITH FULL THICKNESS TEAR INFRASPINATUS RIGHT SIDE	DOMINANT
14	541885	NK	37	FEMALE	2018049746	8/7/2018	DOMESTIC FALL	FULL THICKNESS TEAR SUPRASPINATUS RIGHT SIDE	DOMINANT
15	565043	HC	56	MALE	2018053186	8/21/2018	ROAD SIDE ACCIDENT	FULL THICKNESS TEAR SUPRASPINATUS AND FULL THICKNESS TEAR SUBSCAPULARIS LEFT SIDE	NON DOMINANT
16	311829	K	51	FEMALE	2018063618	10/1/2018	ROAD SIDE ACCIDENT	FULL THICKNESS TEAR OF SUPRASPINATUS RIGHT SIDE	DOMINANT
17	600769	MV	55	MALE	2018066822	10/12/2018	DOMESTIC FALL	FULL THICKNESS SUPRASPINATUS TENDON LEFT SIDE	NON DOMINANT
18	627995	NS	67	MALE	2018079697	11/30/2018	DOMESTIC FALL	FULL THICKNESS TEAR SUPRASPINATUS AND INFRASPINATUS RIGHT SIDE	DOMINANT
19	660930	PK	52	FEMALE	2019006654	1/29/2019	DOMESTIC FALL	FULL THICKNESS TEAR SUPRASPINATUS WITH PARTIAL THICKNESS TEAR INFRASPINATUS RIGHT SIDE	DOMINANT
20	677962	HR	40	MALE	2019013605	2/27/2019	DOEMSTIC FALL	FULL THICKNESS TEAR SUPRASPINATUS RIGHT SIDE	DOMINANT
21	667283	R	54	FEMALE	2019015239	3/6/2019	DOMESTIC FALL	PARTIAL THICKNESS OF SUPRASPINATUS TENDON	DOMINANT
22	681076	KK	63	FEMALE	2019015810	3/28/2019	ROAD SIDE ACCIDENT	FULL THICKNESS SUPRASPINATUS RIGHT SIDE	DOMINANT
23	696879	SK	56	FEMALE	2019020303	3/27/2019	DOMESTIC FALL	FULL THICKNESS TEAR SUPRASPINATUS AND SUBSCAPULARIS RIGHT SIDE	DOMINANT
24	706911	SS	56	MALE	2019024679	4/13/2019	ROAD SIDE ACCIDENT	FULL THICKNESS TEAR SUPRASPINATUS, INFRASPINATUS AND SUBSCAPULARIS	DOMINANT
25	769763	VP	49	MALE	2019049527	7/22/2019	SPORTS INJURY	FULL THICKNESS TEAR SUPRASPINATUS WITH PARTIAL TEAR INFRASPINATUS AND SUBSCAPULARIS	DOMINANT
26	444568	SK	38	MALE	2019050096	7/23/2019	DOMESTIC FALL	FULL THICKNESS SUPRASPINATUS WITH PARTIAL TEAR INFRASPINATUS	DOMINANT
27	797428	AG	27	MALE	2019059281	8/28/2019	DOMESTIC FALL	FULL THICKNESS TEAR SUPRASPINATUS WITH PARTIAL THICKNESS TEAR INFRASPINATUS AND SUBSCAPULARIS RIGHT SIDE	DOMINANT
28	793735	IK	54	FEMALE	2019061240	9/4/2019	DOMESTIC FALL	FULL THICKNESS TEAR SUPRASPINATUS WITH PARTIAL THICKNESS TEAR INFRASPINATUS LEFT SIDE	DOMINANT
29	814072	GS	50	MALE	2019065979	9/21/2019	DOMESTIC FALL	FULL THICKNESS TEAR SUPRASPINATUS LEFT SIDE	NON DOMINANT
30	824526	NS	60	MALE	2019070019	10/6/2019	DOMESTIC FALL	FULL THICKNESS TEAR SUPRASPINATUS WITH PARTIAL TEAR SUBSCAPULARIS RIGHT SIDE	DOMINANT
31	838549	SG	55	MALE	2019076328	10/29/2019	SUDDEN JERK WHILE WORKING	FULL THICKNESS TEAR SUPRASPINATUS AND FULL THICKNESS TEAR INFRASPINATUS RIGHT SIDE	DOMINANT
32	96536	HK	60	FEMALE	2019088293	12/10/2019	DOMESTIC FALL	FULL THICKNESS TEAR SUPRASPINATUS AND FULL THICKNESS TEAR INFRASPINATUS RIGHT SIDE	DOMINANT
33	891603	BS	59	MALE	2020008229	2/4/2020	ROAD SIDE ACCIDENT	FULL THICKNESS TEAR SUPRASPINATUSWITH PARTIAL THICKNESS INFRASPINATUS RIGHT SIDE	DOMINANT
34	833805	RK	40	MALE	2020008866	2/6/2020	ROAD SIDE ACCIDENT	PARTIAL THICKNESS INFRASPINATUS TEAR RIGHT SIDE	DOMINANT
35	916093	KG	59	FEMALE	2020018410	3/13/2020	DOMESTIC FALL	FULL THICKNESS TEAR SUPRASPINATUS RIGHT SIDE WITH SUBACROMIAL IMPINGEMENT	DOMINANT
36	911565	RK	41	MALE	2020018413	3/13/2020	DOMESTIC FALL	FULL THICKNESS TEAR SUPRASPINATUS RIGHT SIDE.	DOMINANT
37	919669	KS	46	MALE	2020020191	3/20/2020	DOMESTIC FALL	FULL THICKNESS TEAR SUPRASPINATUS RIGHT SIDE.	DOMINANT

S. NO	MRD	DATE OF SURGERY	TECHNIQUE USED	CLINICAL EXAMINATION				INTRA OPERATIVE FINDINGS												ACTI
				SUPRASPINATUS	INFRASPINATUS	SUBSCAPULARIS	TERES MINOR	COMPLICATIONS					PAIN			FUNCTION				
				EMPTY CAN TEST (JOBE TEST)	DROP SIGN	LIFT OFF TEST	EXTERNAL ROTATION STRESS TEST	NERVE INJURY (TEMPORARY / PERMANENT)	INFECTION	STIFFNESS	INFLAMMATORY REACTION	OSTEOARTHRITIS	0 Month	1 Month	6 Months	0 Month	1 month	6 Months	0 Month
1	227069	3/23/2017	3 ANCHORS SINGLE ROW	POSITIVE	NEGATIVE	NEGATIVE	NEGATIVE	NO	NO	NO	NO	NO	2	6	8	2	4	8	2
2	231596	4/27/2017	SINGLE ANCHOR SUTURE USED	POSITIVE	NEGATIVE	NEGATIVE	NEGATIVE	NO	NO	NO	NO	NO	4	4	8	4	4	10	2
3	272236	5/25/2017	2 ANCHORS SINGLE ROW	POSITIVE	NEGATIVE	NEGATIVE	NEGATIVE	NO	NO	NO	NO	NO	2	6	8	2	4	8	2
4	290914	6/22/2017	2 ANCHORS DOUBLE ROW	POSITIVE	NEGATIVE	NEGATIVE	NEGATIVE	NO	NO	NO	NO	NO	4	6	8	4	4	8	2
5	294126	6/29/2017	3 ANCHORS SINGLE ROW	POSITIVE	NEGATIVE	POSITIVE	NEGATIVE	NO	NO	NO	NO	NO	4	6	8	4	4	8	1
6	354430	9/23/2017	SINGLE ANCHOR SUTURE USED	POSITIVE	POSITIVE	NEGATIVE	NEGATIVE	NO	NO	NO	NO	NO	4	6	8	2	4	8	2
7	44647	11/14/2017	3 ANCHORS SINGLE ROW	POSITIVE	POSITIVE	POSITIVE	POSITIVE	NO	NO	NO	NO	NO	1	6	8	1	4	8	1
8	397343	12/2/2017	2 ANCHORS SINGLE ROW	POSITIVE	NEGATIVE	NEGATIVE	NEGATIVE	NO	NO	NO	NO	NO	4	6	10	4	4	8	2
9	436292	3/8/2018	2 ANCHORS DOUBLE ROW	POSITIVE	NEGATIVE	NEGATIVE	NEGATIVE	NO	NO	NO	NO	NO	1	6	8	2	4	8	2
10	415197	4/3/2018	2 ANCHORS SINGLE ROW	POSITIVE	NEGATIVE	NEGATIVE	NEGATIVE	NO	NO	NO	NO	NO	1	6	8	2	6	8	1
11	496840	5/12/2018	SINGLE ANCHOR SUTURE USED	POSITIVE	NEGATIVE	POSITIVE	NEGATIVE	NO	NO	NO	NO	NO	4	6	8	4	8	8	2
12	535305	7/19/2018	2 ANCHORS SINGLE ROW	POSITIVE	NEGATIVE	POSITIVE	NEGATIVE	NO	NO	NO	NO	NO	4	6	8	4	4	8	3
13	534603	7/24/2018	2 ANCHORS DOUBLE ROW	POSITIVE	POSITIVE	POSITIVE	POSITIVE	NO	NO	NO	NO	NO	1	6	8	2	6	8	1
14	541885	8/8/2018	2 ANCHORS DOUBLE ROW	POSITIVE	NEGATIVE	POSITIVE	NEGATIVE	NO	NO	NO	NO	NO	2	6	8	2	8	8	2
15	565043	8/23/2018	SINGLE ANCHOR SUTURE USED	POSITIVE	NEGATIVE	POSITIVE	NEGATIVE	NO	NO	NO	NO	NO	2	6	8	2	4	8	3
16	311829	10/2/2018	2 ANCHORS DOUBLE ROW	POSITIVE	POSITIVE	NEGATIVE	NEGATIVE	NO	NO	NO	NO	NO	2	6	8	2	6	10	2
17	600769	10/13/2018	2 ANCHORS DOUBLE ROW	POSITIVE	NEGATIVE	NEGATIVE	NEGATIVE	NO	NO	NO	NO	NO	2	6	8	1	8	8	2
18	627995	12/1/2018	2 ANCHORS SINGLE ROW	POSITIVE	POSITIVE	POSITIVE	POSITIVE	NO	NO	NO	NO	NO	1	6	8	2	4	6	1
19	660930	1/30/2019	SINGLE ANCHOR SUTURE USED	POSITIVE	POSITIVE	POSITIVE	POSITIVE	NO	NO	NO	NO	NO	2	6	8	2	6	8	2
20	677962	2/28/2019	2 ANCHORS SINGLE ROW	POSITIVE	NEGATIVE	NEGATIVE	NEGATIVE	NO	NO	NO	NO	NO	4	6	8	4	8	10	2
21	667283	3/7/2019	SINGLE ANCHOR SUTURE USED	POSITIVE	NEGATIVE	NEGATIVE	NEGATIVE	NO	NO	NO	NO	NO	4	6	8	4	6	8	2
22	681076	3/9/2019	2 ANCHORS SINGLE ROW	POSITIVE	NEGATIVE	NEGATIVE	NEGATIVE	NO	NO	NO	NO	NO	4	6	10	6	6	8	3
23	696879	3/28/2019	2 ANCHORS SINGLE ROW	POSITIVE	NEGATIVE	POSITIVE	NEGATIVE	NO	NO	NO	NO	NO	4	6	8	4	8	8	2
24	706911	4/14/2019	SINGLE ANCHOR SUTURE USED	POSITIVE	POSITIVE	POSITIVE	POSITIVE	NO	NO	NO	NO	NO	2	6	8	4	4	8	2
25	769763	7/23/2019	2 ANCHORS DOUBLE ROW	POSITIVE	POSITIVE	POSITIVE	NEGATIVE	NO	NO	NO	NO	NO	1	6	8	1	6	8	0
26	444568	7/24/2019	2 ANCHORS DOUBLE ROW	POSITIVE	POSITIVE	NEGATIVE	NEGATIVE	NO	NO	NO	NO	NO	1	6	8	1	6	8	0
27	797428	8/29/2019	2 ANCHORS DOUBLE ROW	POSITIVE	POSITIVE	POSITIVE	NEGATIVE	NO	NO	NO	NO	NO	2	6	8	4	6	8	3
28	793735	9/5/2019	2 ANCHORS SINGLE ROW	POSITIVE	POSITIVE	POSITIVE	NEGATIVE	NO	NO	NO	NO	NO	1	6	10	2	6	8	2
29	814072	9/22/2019	2 ANCHORS SINGLE ROW	POSITIVE	NEGATIVE	POSITIVE	NEGATIVE	NO	NO	NO	NO	NO	2	6	8	6	6	8	2
30	824526	10/7/2019	SINGLE ANCHOR SUTURE USED	POSITIVE	NEGATIVE	POSITIVE	NEGATIVE	NO	NO	NO	NO	NO	2	6	8	4	4	8	3
31	838549	10/30/2019	3 ANCHORS DOUBLE ROW	POSITIVE	POSITIVE	POSITIVE	NEGATIVE	NO	NO	NO	NO	NO	4	6	10	4	4	10	2
32	96536	12/11/2019	SINGLE ANCHOR SUTURE USED	POSITIVE	POSITIVE	POSITIVE	POSITIVE	NO	NO	NO	NO	NO	2	6	8	2	4	8	1
33	891603	2/6/2020	2 ANCHORS DOUBLE ROW	POSITIVE	POSITIVE	NEGATIVE	POSITIVE	NO	NO	NO	NO	NO	2	6	8	1	6	8	0
34	833805	2/7/2020	SINGLE ANCHOR SUTURE USED	POSITIVE	POSITIVE	NEGATIVE	NEGATIVE	NO	NO	NO	NO	NO	4	6	8	4	8	8	3
35	916093	3/14/2020	2 ANCHORS DOUBLE ROW	POSITIVE	NEGATIVE	NEGATIVE	NEGATIVE	NO	NO	NO	NO	NO	2	6	8	2	4	8	1
36	911565	3/14/2020	2 ANCHORS SINGLE ROW	POSITIVE	POSITIVE	NEGATIVE	NEGATIVE	NO	NO	NO	NO	NO	4	6	8	4	8	8	2
37	919669	3/21/2020	2 ANCHORS DOUBLE ROW	POSITIVE	NEGATIVE	NEGATIVE	NEGATIVE	NO	NO	NO	NO	NO	2	6	8	4	6	8	2

S. NO	MRD	UCLA SHOULDER SCORE											FINAL FUNCTIONAL OUTCOME
		VE FORWARD FLEXION		STRENGTH OF FORWARD FLEXION (MANUAL MUSCLE TESTING)			SATISFACTION OF PATIENT			TOTAL SCORE			
		1 month	6 Months	0 Month	1 month	6 Months	0 Month	1 month	6 Months	0 Month	1 month	6 Months	
1	227069	3	4	3	4	4	0	5	5	9/35.	22/35.	29/35	GOOD
2	231596	3	5	3	4	4	0	5	5	13/35.	20/35.	32/35.	GOOD
3	272236	3	5	3	4	4	0	5	5	9/35.	22/35.	30/35	GOOD
4	290914	3	4	3	4	4	0	5	5	13/35.	22/35	29/35.	GOOD
5	294126	3	4	3	4	5	0	5	5	12/35.	22/35	30/35.	GOOD
6	354430	3	4	4	4	5	0	5	5	12/35.	22/35	30/35.	GOOD
7	44647	3	4	3	4	4	0	5	5	6/35.	22/35.	29/35.	GOOD
8	397343	3	4	3	4	5	0	5	5	13/35.	22/35	32/35.	GOOD
9	436292	3	4	2	4	4	0	5	5	07/35.	22/35	29/35.	GOOD
10	415197	3	5	2	4	4	0	5	5	7/35.	24/35	30/35.	GOOD
11	496840	3	5	4	4	5	0	5	5	14/35.	22/35	31/35.	GOOD
12	535305	3	5	3	4	5	0	5	5	14/35.	22/35	31/35.	GOOD
13	534603	3	3	2	4	3	0	5	5	6/35.	24/35	30/35.	GOOD
14	541885	3	5	3	4	5	0	5	5	9/35.	26/35	31/35.	GOOD
15	565043	3	5	3	4	5	0	5	5	10/35.	22/35	31/35.	GOOD
16	311829	3	5	3	4	5	0	5	5	9/35.	24/35	33/35.	GOOD
17	600769	3	5	3	3	4	0	5	5	8/35.	23/35	30/35.	GOOD
18	627995	3	4	3	3	5	0	0	5	7/35.	21/35	28/35.	GOOD
19	660930	3	4	3	3	5	0	5	5	9/35.	23/35	30/35.	GOOD
20	677962	3	5	3	3	5	0	0	5	13/35.	20/35	33/35.	GOOD
21	667283	3	4	4	3	5	0	0	5	14/35.	16/35	30/35.	GOOD
22	681076	3	5	4	3	5	0	0	5	14/35.	18/35	33/35.	GOOD
23	696879	3	4	3	3	5	0	5	5	13/35.	20/25	29/35.	GOOD
24	706911	3	4	4	4	5	0	5	5	12/35.	22/35	30/35.	GOOD
25	769763	3	4	3	3	5	0	5	5	5/35.	23/35	30/35.	GOOD
26	444568	3	4	2	3	4	0	5	5	4/35.	23/35	28/35.	GOOD
27	797428	3	5	3	3	5	0	5	5	12/35.	23/35	31/35.	GOOD
28	793735	3	5	3	3	4	0	5	5	8/35.	23/35	32/35.	GOOD
29	814072	3	5	4	3	5	0	5	5	14/35.	23/35	31/35.	GOOD
30	824526	3	5	3	3	5	0	5	5	12/35.	21/35	31/35.	GOOD
31	838549	3	5	3	3	5	0	5	5	13/35.	21/35	35/35.	EXCELLENT
32	96536	3	4	3	3	4	0	0	5	8/35.	16/35	29/35.	GOOD
33	891603	3	4	2	3	4	0	0	5	5/35.	18/35	29/35.	GOOD
34	833805	3	5	3	4	5	0	0	5	14/35.	21/35	31/35.	GOOD
35	916093	3	4	3	3	4	0	0	5	8/35.	16/35	29/35.	GOOD
36	911565	3	4	3	3	4	0	5	5	13/35.	25/35	29/35.	GOOD
37	919669	3	4	3	3	5	0	5	5	11/35.	23/35	30/35.	GOOD

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Date 9/12/19

The Principal,
DMC, Ludhiana.

Subject: **Approval of Plan of Thesis.**

This is to inform you that the Faculty of Medical Sciences in its meeting held on 29.05.2019 has approved the plan of thesis of **Nitish Khosla**, a student of your college for **MS Orthopaedics** along with the names of Supervisor/Co-Supervisor as under:-

Topic Plan of Thesis

To determine shoulder function after arthroscopic rotator cuff repair

Supervisor
Dr. Rajnish Garg
Prof. & Head,
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DMCH, Ludhiana.

Co-Supervisor
Dr. Pankaj Mahindra
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The student has to submit the four copies of thesis (along with PDF format) , to the Controller of Examinations, BFUHS, Faridkot, at least six months before the commencement of theory examination, if he/she is otherwise eligible to take the examination. He /She must directed to attach a photocopy of this letter with the forwarding letter while submitting thesis to the University along with the letter of approval of University for change of supervisor/Co-Supervisor, change of topic,(if any).

Dr. S P Singh MS(Oph)
Controller of Examinations

Note :

1. *If any discrepancy found regarding topic of thesis or Supervisor/Co-Supervisor, inform undersigned within one month after issue of this letter.*
2. *The student may submit the thesis as per the schedule already conveyed i.e for May/June examination 30th Nov of the preceding the year of examination and for Nov/Dec examinations 31st May of the year of examination.*

TO DETERMINE SHOULDER FUNCTION AFTER ARTHROSCOPIC ROTATOR CUFF REPAIR

THESIS PROPOSAL

FOR APPROVAL OF SUBJECT OF THESIS TO BE SUBMITTED

IN PARTIAL FULFILMENT OF THE REQUIREMENTS

FOR THE DEGREE OF

MASTER OF SURGERY

IN

ORTHOPAEDICS

OF THE

BABA FARID UNIVERSITY OF HEALTH SCIENCES

FARIDKOT

NOVEMBER, 2018

DR. NITISH KHOSLA

DEPARTMENT OF ORTHOPAEDICS

DAYANAND MEDICAL COLLEGE & HOSPITAL, LUDHIANA

ABSTRACT OF PLAN OF THESIS

Title	TO DETERMINE SHOULDER FUNCTION AFTER ARTHROSCOPIC ROTATOR CUFF REPAIR
For the degree of	MS ORTHOPAEDICS
Name of the candidate	Dr. Nitish Khosla
Supervisor	Dr. Rajnish Garg, Professor & Head, Department of Orthopaedics, DMCH, Ludhiana
Co-supervisors	Dr. Pankaj Mahindra, Associate Professor, Department of Orthopaedics, DMCH, Ludhiana
Institution	Dayanand Medical College & Hospital, Ludhiana
University	Baba Farid University of Health Sciences, Faridkot

Introduction: Rotator cuff tears are a common contributing factor of shoulder pain and occupational disability. Tears of the rotator cuff are becoming increasingly prevalent in today's population. Shoulder arthroscopy has become a reliable and reproducible method of treating rotator cuff tears

Aim: To Determine Shoulder Function After Arthroscopic rotator cuff repair .

Material & Methods: A prospective and retrospective review of the medical records of all cases of rotator cuff tear who will undergo shoulder arthroscopy between January 2017 to May 2020 at Dayanand Medical college Hospital, Ludhiana will be performed.

Clinical Significance: With the advancement of science and technology, a arthroscopic rotator cuff repair is a minimally invasive technique compared with the conventional rotator cuff repair procedure used in the past. It is a valuable way to treat rotator cuff tears. Orthopedic surgeons can evaluate the entire shoulder joint and fix tears through very small incisions using specially-designed instruments and devices. Large tears are particularly appropriate to arthroscopic repair because of the ability to visualize and access to the tear.

Keywords: Rotator Cuff, Shoulder Arthroscopy

(Signature)	(Signature)	(Signature)	(Signature)
Candidate	Co-supervisor	Supervisor	Principal

CERTIFICATE OF FACILITIES AVAILABLE

This is to certify that the facilities for work on the subject of thesis titled **"TO DETERMINE SHOULDER FUNCTION AFTER ARTHROSCOPIC ROTAOTR CUFF REPAIR"** exist in the Department of Orthopaedics, DMC&H, Ludhiana, and will be provided to the candidate. We will see that the data being included in the thesis are genuine and is collected by the candidate himself under our supervision and guidance.

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Place: Ludhiana

Date: 18/12/18

APPROVAL PROFORMA
BY RESEARCH & ETHICAL COMMITTEE
DAYANAND MEDICAL COLLEGE & HOSPITAL, LUDHIANA

Name of candidate	Dr Nitish Khosla
Department	ORTHOPAEDICS
Topic of Thesis	FUNCTIONAL OUTCOME OF ARTHROSCOPIC REPAIR OF ROTATOR CUFF TEAR
Likely date of appearing in PG examination	JUNE 2021
Date of enrollment	10th May, 2018
Name of Head of Department	Dr. Rajnish Garg
1. **Supervisor** 2. **Co-Supervisor**	Dr Rajnish Garg Dr. Pankaj Mahindra
Signature of Members of Research Committee with Stamp	**Signature of Members of Ethics Committee with Stamp**
1. HOD Pharmacology	1. HOD Physiology
2. HOD Surgery	2. HOD Pathology
3. HOD Pathology	3. HOD Pharmacology
4. HOD Medicine	4. HOD SPM
5. Dean Academics	5. HOD Medicine
6. Vice Principal	6. HOD Surgery
	7. HOD Obst. & Gynae.
	8. Legal Expert
	9. Secretary, IEC
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	11. Vice Principal
	12. Principal

Approved: Yes / No

Chairperson
Research Committee

Chairperson
Research Committee

Approved: Yes / ~~No~~

Chairperson
Ethics Committee

Chairperson
Ethics Committee

BABA FARID UNIVERSITY OF HEALTH SCIENCES, FARIDKOT

PROFORMA FOR REGISTRATION OF SUBJECT FOR DISSERTATION

1	NAME OF THE CANDIDATE AND ADDRESS	DR NITISH KHOSLA H.NO 23, PHASE 6, SAS NAGAR (MOHALI)
2	NAME OF THE INSTITUTE	DAYANAND MEDICAL COLLEGE AND HOSPITAL
3	COURSE OF STUDY AND SUBJECT	MASTER OF SURGERY, ORTHOPAEDICS
4	DATE OF ADMISSION OF COURSE	10TH MAY, 2018
5	TITLE OF THE TOPIC	TO DETERMINE SHOULDER FUNCTION AFTER ARTHROSCOPIC ROTATOR CUFF REPAIR

6. BRIEF RESUME OF INTENDED WORK:

6.1 NEED FOR STUDY

Rotator cuff injuries are very common, ranging from 5%-39%. They are the leading cause of shoulder pain, and have a high prevalence in the aging population.[1] They can cause intense shoulder pain, functional limitation and decreased quality of life.[2-7] It is extremely important to understand these injuries to treat them appropriately, as it is likely that every physician, not just orthopedic surgeons, will encounter this pathology.

The rotator cuff is a group of muscles that cover the humeral head and plays an important role in the strength, mobility and stability of the shoulder by fixing the humeral head to the glenoid. The rotator cuff consists of four muscles: Subscapularis, supraspinatus, infraspinatus and teres minor. The tendons of these muscles merge with the joint capsule. Around the shoulder joint and between the tendons of the rotator cuff muscles and the fibrous joint capsule, bursa reduces the friction of the tendons that pass over bone or other areas of resistance.[8] In general, the treatment for rotator cuff tears should be clinical, even in cases in which anatomic changes are also present.[9]

However, in cases of rotator cuff failures, surgical treatment is indicated. Rotator cuff repairs can be performed through either arthroscopic or open approaches. Arthroscopic surgery is performed through micro incisions and preserves the deltoid muscle insertion, theoretically permitting early rehabilitation and a lower risk of iatrogenic injuries or complications from deltoid healing.

The causes of rotator cuff tears are multifactorial. However, it is believed that degeneration is an essential factor, as this leads to a high rate of non-healing or failures, which range from 10%-94%.[10-15] In most cases, rotator cuff tears are slow and progressive injuries, occurring after a relatively long period of symptoms.

However, acute tears can also occur secondary to trauma. This mechanism has been found to have better functional and pain outcomes than chronic injuries.

Arthroscopic rotator cuff repair is being performed by an increasing number of orthopaedic surgeons. The principles, techniques, and instrumentation have evolved to the extent that all patterns and sizes of rotator cuff tear, including massive tears, can now be repaired arthroscopically. Achieving a biomechanically stable construct is critical to biologic healing. The ideal repair construct must optimize suture-to-bone fixation, suture-to-tendon fixation, abrasion resistance of suture, suture strength, knot security, loop security, and restoration of the anatomic rotator cuff footprint (the surface area of bone to which the cuff tendons attach). By achieving optimized repair constructs, experienced arthroscopic surgeons are reporting results equal to those of open rotator cuff repair. As surgeons' arthroscopic skill levels increase through attendance at surgical skills courses and greater experience gained in the operating room, there will be an increasing trend toward arthroscopic repair of most rotator cuff pathology.

Studying about the functional outcome of rotator cuff tear after arthroscopic repair may help us understand the post-surgical function of these patients, and support clinical decision making.

The Functional outcome will be assessed by using the UNIVERSITY OF CALIFORNIA AND LOS ANGLES SCORE (UCLA) which involves:-

1. Pain
2. Function
3. Active forward flexion
4. Strength of forward flexion (manual muscle testing)
5. Satisfaction of patient

6.2 REVIEW OF LITERATURE

Deutsch A et al conducted a study on repair integrity and clinical outcome after arthroscopic rotator cuff repair using single-row anchor fixation: a prospective study of single-tendon and two-tendon tears.

This prospective study determined whether single-row anchor fixation would reliably improve clinical outcome and maintain structural integrity after arthroscopic repair of single-tendon and 2-tendon rotator cuff tears. In 39 patients, 21 shoulders had single-tendon tears and 18 had 2-tendon tears.

Postoperative magnetic resonance imaging (MRI) was performed at a minimum 1-year follow-up. Postoperative MRI examinations showed 19 cuffs (90%) were intact for single-tendon tears and 15 (83%) were intact for 2-tendon tears. A recurrent tear on postoperative MRI was significantly correlated with the intraoperative finding of asymmetric retraction.

Arthroscopic rotator cuff repair using single-row anchor fixation resulted in significant improvements in clinical outcome and reliable repair integrity for both single tendon and 2-tendon tears.[16]

Miyazaki AN et al conducted a study to evaluation of the results from arthroscopic repair on rotator cuff injuries among patients under 50 years of age. The study included all patients with rotator cuff injuries who were under 50 years of age and had been followed up postoperatively for at least 24 months.

According to the UCLA evaluation criteria, 59 patients (92%) showed excellent and good results; five (8%) showed fair results; and none showed poor results. The postoperative evaluation showed that the mean range of

motion was 145° for elevation, 47° for lateral rotation and T10 for medial rotation. Unsatisfactory results were associated with prolonged duration of the injury, with a statistically significant relationship.

Conclusion: Arthroscopic repair of rotator cuff injuries in young patients produces excellent or good results for most patients.[17]

PASCAL BOILEAU et al conducted a study to evaluate Arthroscopic Repair of Full-Thickness Tears of the Supraspinatus and to evaluate whether tendon really heal or not. Sixty-five consecutive shoulders with a chronic full-thickness supraspinatus tear were repaired arthroscopically in sixty-five patients with use of a tension-band suture technique. The average strength of the shoulder elevation was significantly better when the tendon had healed than when it had not. Factors that were negatively associated with tendon healing were increasing age and associated delamination of the subscapularis or infraspinatus tendon. Only ten (43%) of twenty-three patients over the age of sixty-five years had completely healed tendons ($p < 0.001$).[18]

Gartsman GM et al conducted a study to compare the structural outcomes of a single-row rotator cuff repair and double-row suture bridge fixation after arthroscopic repair of a full-thickness supraspinatus rotator cuff tear. They evaluated with diagnostic ultrasound a consecutive series of ninety shoulders in ninety patients with full-thickness supraspinatus tears at an average of 10 months (range, 6-12) after operation. A single surgeon at a single hospital performed the repairs. Inclusion criteria were full-thickness supraspinatus tears less than 25 mm in their anterior to posterior dimension.

Forty-three shoulders were repaired with single-row technique and 47 shoulders with double-row suture bridge technique. Postoperative rehabilitation was identical for both groups. Ultrasound criteria for healed repair included visualization of a tendon with normal thickness and length, and a negative compression test.

Arthroscopic double-row suture bridge repair (transosseous equivalent) of an isolated supraspinatus rotator cuff tear resulted in a significantly higher tendon healing rate (as determined by ultrasound examination) when compared to arthroscopic single-row repair.[19]

Kyung Cheon Kim et al conducted a study to evaluate the clinical and imaging outcomes of arthroscopic suture-bridge repair of full-thickness rotator cuff tears. Seventy-nine patients with a full-thickness rotator cuff tear consecutively underwent arthroscopic suture-bridge repair. The mean age of the patients was 58.3 years (range, thirty-eight to seventy eight years), and the mean duration of follow-up was 30.6 months (range, twenty-four to forty-four months).University of California at Los Angeles (UCLA), American Shoulder and Elbow Surgeons (ASES), and Constant-Murley scores were used for clinical and functional evaluations before surgery and at the time of final follow-up.

Arthroscopic suture-bridge repair of full-thickness rotator cuff tears was followed by a re-tear rate of 15% as seen with imaging and resulted in significant improvement of functional outcomes and clinical results compared with the preoperative findings.[20]

Cho NS et al conducted a study to evaluate Functional outcome of arthroscopic repair with concomitant manipulation in rotator cuff tears with stiff shoulder. Among patients who underwent arthroscopic rotator cuff repairs, 15 cases with preoperative shoulder stiffness (group A) and 30 without shoulder stiffness (group B) were enrolled in this study. Pain, range of motion, muscle strength, and function all significantly improved after arthroscopic rotator cuff repair, regardless of the presence of shoulder stiffness. Patients with full-thickness rotator cuff tears and stiffness of the shoulder can be treated with a single surgery and concomitant manipulation with overall good results. Although final outcomes were as good as those in patients without stiffness, the return of range of motion took longer in those patients undergoing manipulation for stiffness of the shoulder.[21]

6.3 AIMS AND OBJECTIVES OF THE STUDY

1. TO DETERMINE SHOULDER FUNCTION AFTER ARTHROSCOPIC ROTATOR CUFF REPAIR
2. To assess complications after arthroscopic rotator cuff repair.

7.0 MATERIALS AND METHODS

7.1 SOURCE OF DATA

The purpose of our study is to review and analyse the functional outcome of rotator cuff tears after arthroscopic repair. A prospective and retrospective review of the medical records of all cases of rotator cuff tears who will undergo shoulder arthroscopy between Jan 2017 and May 2020 at Dayanand Medical college Hospital, Ludhiana will be performed.

7.2 METHOD OF COLLECTION OF DATA

Inclusion Criteria:

- Patents with repairable rotator cuff tears diagnosed after clinical examination or ultrasound or magnetic resonance imaging
- Rotator cuff tear repaired solely with the use of arthroscopy
- Patients who give informed consent and willing for follow up

Exclusion Criteria:

- Rotator cuff tear repaired with open surgery
- Massive irreaparable rotator cuff tear
- Severe glenohumeral arthritis
- Biceps injury requiring tenotomy or tenodesis
- Patient managed conservatively

Medical records will be studied to obtain demographic data including patient age and gender, mechanism of injury, date of injury, date of surgery. Operative reports will be reviewed to determine the specific fixation technique. Retrospective Study will be done based on the information obtained from the documentation in the follow-up records. The follow-up information also

included occurrence of late complication or the need for additional surgery including implant removal. The duration and physiotherapy programme followed will be noted. The minimum period of follow-up will be 1 month and maximum period 6 month. Patients will be assessed as per the UCLA Shoulder scoring system. The final functional outcome will be graded as Good/Excellent (Score >27)and Fair/Poor (Score <27) as per documented in the UCLA shoulder rating sheet.

OUTCOME

The final functional outcome will be graded as Good/Excellent (Score >27) and Fair/Poor (Score <27) as per documented in the UCLA shoulder rating sheet.

STATISTICAL ANALYSIS

Data will be described in terms of range; mean ±standard deviation (± SD), median, frequencies (number of cases) and relative frequencies (percentages) as appropriate. All statistical calculations will be done using SPSS (Statistical Package for the Social Science) SPSS 21 version statistical program for Microsoft Windows.

7.3 DOES THE STUDY REQUIRE ANY INVESTIGATIONS OR INTERVENTIONS TO BE CONDUCTED ON PATIENTS OR OTHER HUMANS OR ANIMALS? IF SO, PLEASE DESCRIBE BRIEFLY.

NO

7.4 HAS THE ETHICAL CLEARANCE BEEN OBTAINED FROM ETHICAL COMMITTEE OF YOUR INSTITUTION IN CASE OF 7.3?

Yes, attached herewith.

8. LIST OF REFERENCES

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PROFORMA

NAME : AGE SEX

MRD NO ADMISSION NO

DATE OF ADMISSION

DATE OF INJURY

MECHANISM OF INJURY

DATE OF FIRST CONSULTATION

DATE OF SURGERY

DETAILS OF PATIENT:

PROFESSION:

LABOURER/ATHLETE/HOUSEWIFE/AGRICULTARIST/DRIVER/UNEMPLOYED/OTHER

CLINICAL EXAMINATION :		POSITIVE	NEGATIVE
SUPRASPINATUS –	EMPTY CAN TEST (JOBE TEST)		
	EXTERNAL ROTATION LAG SIGN		
INFRASPINATUS-	EXTERNAL ROTATION STRESS TEST		
	DROP SIGN		
	EXTERNAL ROTATION LAG SIGN		
SUBSCAPULARIS-	LIFT OFF TEST		
	BELLY PRESS TEST		
	INTERNAL ROTATION LAG SIGN		
TERES MINOR-	PATTE SIGN (HORNBLOWER SIGN)		
	EXTERNAL ROTATION STRESS TEST		

Signature of Candidate **Signature of Supervisor**

RADIOLOGICAL EXAMINATION :

A.ULTRASOUND FINDINGS

B.MRI FINDINGS

INTRA OPERATIVE FINDINGS:

COMPLICATIONS:	YES/NO
NERVE INJURY (TEMPORARY / PERMANENT)	
INFECTION	
STIFFNESS	
INFLAMMATORY REACTION	
OSTEOARTHRITIS	

Signature of Candidate

Signature of Supervisor

UCLA SHOULDER SCORE				
Criteria	Findings	Score	0 Month	6 Months
PAIN				
	Present always and unbearable; strong medication frequently	1		
	Present always and unbearable; strong medication occasionally	1		
	None or little at rest present during light activities,salicylates used frequently	4		
	Present during heavy or particular activities only, salicylates used occasionally	6		
	Occasional and slight	8		
	None	10		
FUNCTION				
	Unable to use limb	1		
	Only light activities possible	2		
	Able to do light household or most activities of daily living	4		
	Most housework, shopping and driving possible; able to do hair and to dress and undress	6		
	Slight restriction only; able to wok above shoulder level	8		
	Normal activities	10		
ACTIVE FORWARD FLEXION				
	150 degree	5		
	120-150	4		
	90-120	3		
	45-90	2		
	30-45	1		
	< 30	0		

Signature of Candidate **Signature of Supervisor**

STRENGTH OF FORWARD FLEXION (MANUAL MUSCLE TESTING)				
	Grade 5(normal)	5		
	Grade 4 (good)	4		
	Grade 3 (fair)	3		
	Grade 2 (poor)	2		
	Grade 1 (muscle concentration)	1		
	Grade 0 (nothing)	0		
SATISFACTION OF PATIENT				
	SATISFIED AND BETTER	5		
	NOT SATISFIED AND WORSE	0		

PATIENT'S UCLA SHOULDER SCORE IS : _____

> 27 GOOD/EXCELLENT <27 FAIR/POOR

The Maximum score is 35 points. **Excellent / good indicates satisfactory results, where as fair / poor indicates unsatisfactory results.**

Signature of Candidate **Signature of Supervisor**

INFORMED PATIENT CONSENT

Date: _____

I.....D/o, W/o, S/o.....

am willing to participate in the study **"TO DETERMINE SHOULDER FUNCTION AFTER ARTHROSCOPIC ROTATOR CUFF REPAIR"** The procedure with its complications has been explained to me in local vernacular language. I have fully understood that no special tests and extra expenditure in any form, merely for the purpose of thesis is being carried out. I am free to opt out the study any time without assigning any reason.

.....
Signature of the Witness

Name:

.....
Signature of the patient

Signature of Candidate

Signature of Supervisor

मरीज अनुमति फार्म

तिथि _____

मैं _____ पत्नी/पुत्र/पुत्री _____ निवासी _____ इस शोधकार्य **"TO DETERMINE SHOULDER FUNCTION AFTER ARTHROSCOPIC ROTATOR CUFF REPAIR"** में भाग लेने के लिए सहमत हूँ। मैं इस शोधकार्य में भाग लेने के लिए अपनी स्वेच्छा से तैयार हूँ। मैं पुष्टि करता/करती हूँ की यह स्वीकृति देने के लिए मुझे कोई आर्थिक प्रलोभन नहीं दिया गया और न ही दबाव डाला गया है। मुझे इस शोधकार्य का उद्देश्य स्पष्ट कर दिया गया है और मुझे यह विश्वास है की यह विज्ञान और मानवता के लाभ के लिए है। मुझे इस शोधकार्य में होने वाले जोखिम के बारे में समझा दिया गया है और मेरी समझ में यह जोखिम बहुत मामुली है।

मैं इस शोधकार्य में भाग लेने के सम्बन्ध में किसी भी समय अपनी अस्वीकृति व्यक्त कर सकता/सकती हूँ और मेरे अस्वीकृति व्यक्त करने का मेरे इलाज पर कोई प्रभाव नहीं पड़ेगा।

_____
गवाह के हस्ताक्षर
नाम:

_____
रोगी के हस्ताक्षर/अंगूठे का निशान
नाम:

_____
अन्वेषक के हस्ताक्षर

_____
विद्यार्थी के हस्ताक्षर

ਮਰੀਜ਼ ਰਜ਼ਾਮੰਦੀ ਫਾਰਮ

ਮਿਤੀ_____

ਮੈ_____ਪਤਨੀ/ਪੁੱਤਰ/ਪੁੱਤਰੀ_____

ਵਾਸੀ _____

"TO DETERMINE SHOULDER FUNCTION AFTER ARTHROSCOPIC ROTATOR CUFF REPAIR" ਤੇ ਚਲ ਰਹੀ ਖੋਜ ਵਿਚ ਹਿੱਸਾ ਲੈਣ ਲਈ ਰਜ਼ਾਮੰਦ ਹਾਂ। ਇਸ ਖੋਜ ਕੰਮ ਵਿਚ ਹਿੱਸਾ ਲੈਣ ਲਈ ਮੈ ਆਪਣੀ ਮਰਜ਼ੀ ਨਾਲ ਤਿਆਰ ਹਾਂ। ਮੈ ਇਹ ਦਸਣਾ ਚਾਹੁੰਦਾ ਹਾਂ/ ਚਾਹੁੰਦੀ ਹਾਂ ਕੇ ਇਹ ਰਜ਼ਾਮੰਦੀ ਦੇਣ ਵਾਸਤੇ ਮੈਨੂ ਕਿਸੇ ਵੀ ਤਰਾਂ ਦਾ ਲੋਭ-ਲਾਲਚ ਨਹੀ ਦਿੱਤਾ ਗਿਆ ਅਤੇ ਨਾ ਹੀ ਕੋਈ ਦਬਾ ਪਾਇਆ ਗਿਆ ਹੈ। ਮੈਨੂ ਇਸ ਖੋਜ ਦਾ ਮਨੋਰਥ ਸਮਝਾ ਦਿੱਤਾ ਗਿਆ ਹੈ ਅਤੇ ਮੈਨੂ ਇਹ ਭਰੋਸਾ ਦਵਾਇਆ ਗਿਆ ਹੈ ਕੇ ਇਹ ਖੋਜ ਵਿਗਿਆਨ ਅਤੇ ਮਾਨਵਤਾ ਦੀ ਭਲਾਈ ਲਈ ਹੈ। ਮੈਨੂ ਇਸ ਖੋਜ ਵਿਚ ਹੋਣ ਵਾਲੇ ਖਤਰੇ ਬਾਰੇ ਸਮਝਾ ਦਿੱਤਾ ਗਿਆ ਹੈ ਅਤੇ ਮੈਨੂ ਇਹ ਯਕੀਨ ਹੈ ਕੇ ਇਹ ਖਤਰਾ ਬਹੁਤ ਮਾਮੂਲੀ ਹੈ। ਮੈਨੂ ਇਸ ਖੋਜ ਕੰਮ ਵਿਚ ਹਿੱਸਾ ਲੈਣ ਦਾ ਢੰਗ – ਤਰੀਕਾ ਸਮਝਾ ਦਿੱਤਾ ਗਿਆ ਹੈ।

ਮੈ ਇਸ ਖੋਜ ਕੰਮ ਵਿਚ ਹਿੱਸਾ ਲੈਣ ਬਾਰੇ ਆਪਣੀ ਰਜ਼ਾਮੰਦੀ ਕਿਸੇ ਵੀ ਸਮੇ ਵਾਪਸ ਲੈ ਸਕਦਾ ਹਾਂ/ ਸਕਦੀ ਹਾਂ ਅਤੇ ਮੇਰੀ ਰਜ਼ਾਮੰਦੀ ਵਾਪਸ ਲੈਣ ਦਾ ਮੇਰੇ ਇਲਾਜ ਤੇ ਕੋਈ ਅਸਰ ਨਹੀ ਹੋਵੇਗਾ।

_____ _____

ਗਵਾਹ ਦੇ ਹਸਤਾਖਰ ਮਰੀਜ਼ ਦੇ ਹਸਤਾਖਰ

ਮਿਤੀ_____ ਮਿਤੀ_____

ਪਤਾ _____ ਪਤਾ _____

_____

ਨਿਰੀਖਕ ਦੇ ਹਸਤਾਖਰ

_____

ਸਿਖਿਆਰਥੀ ਦੇ ਹਸਤਾਖਰ